COAL

NOVEMBER, 1961

A McGRAW-HILL PUBLICATION

PRICE \$1

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What's Ahead in Productivity ... and the Capital

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p 60

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Noise From
Blasting
p 72

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Fire-Resistant Fluids . . . What 100% Users Have Found

Equal or better production, no pump problems, lower consumption of hydraulic fluid and lower cost of fluid per ton cited as major benefits from emulsion-type fire-resistant fluids.

HOW DOES emulsion-type fireresistant hydraulic fluid stack up in underground service? How does equipment perform? What about fluid consumption, handling procedures, storage and cost per ton? To get the answers to these and other questions frequently asked about fire-resistant fluids, Coal Age first checked with the manufacturers of approved fluids to arrive at the number of operations using such fluids 100%. This and other checking turned up 13 mines 100% on fire-resistant emulsions as of July 1. All 13 were approached by Coal Age. Nine provided data.

The nine mines which supplied data on their experience to date operate in Kentucky, Pennsylvania and West Virginia. Capacities, derived from data in Keystone Coal Buyers Manual, a Coal Age affiliate, are as follows:

Mine	Capacity, Tons per Day
1	4,500
2	1,000
3	1,200
4	2,250
5	2,250
6	4,300
7	1,300
8	1,000
0	1 500

It should be noted that eight of the nine mines use one brand of premixed emulsion. Therefore, the great majority of the data to follow pertain to this one fluid.

Most of the mines were visited by a member of the Coal Age staff; others supplied detailed answers to

a series of questions designed to bring out experience and results.

The term "100%" is subject to some exceptions. One mine at the time of the survey was keeping one section on conventional fluid until the supply on hand was used up, at which time it planned to go completely emulsion.

Some of the mines have been 100% users of fire-resistant fluid for more than 8 mo, others have used it for 5 to 6 mo and a few have had several months experience. Although

The above is an excerpt from an article in the August issue of Coal Age (p. 55). This article is of tremendous importance to all coal mine operators. Eight of the nine mines reporting use Hul-E-Mul exclusively.

BOX SCORE

Mines using Hul-E-Mul 100% hydraulically 17 Other mines partially using Hul-E-Mul 50 reason, do not operate normally. An added benefit cited by one company is lower operating temperature for equipment as well as excellent performance and response.

What about pump life?

No pump problems resulting from use of the emulsion type fluid have been reported during the period in which the fluid has been used. Several companies say that, although no pump troubles have been noted, they have not had the fire-resistant fluid in service long enough to reach a conclusion.

The majority, however, believe they have had enough experience and therefore have formed opinions. One company, for example, has been using the emulsion-type fluid for 6 mo and reports that no pumps failed. Another notes that pump troubles have been non-existent in the 3 mo that the emulsion type fluid has been used. It adds that some pump trouble could normally be expected in this period.

Pump and motor life are better than with premium-quality petroleum oil, reports another operator. The company has not had the failures sometimes experienced with conventional fluid.

After conventional fluid was replaced with the emulsion-type fluid, a very significant reduction of 75% in fluid loss through a leaking pump was noted at another company.



FIRE-RESISTANT HYDRAULIC FLUID
A product of HULBURT OIL & GREASE COMPANY
Philadelphia 34, Pennsylvania



New B.F.Goodrich tire compound takes 90-ton jolts in stride

MINING COMPANY FINDS BFG TIRES LAST 4,000 HOURS ON ORIGINAL TREAD

That giant tractor-trailer hauls 90 tons of coal at a clip from mine to tipple. It's part of the fleet operated by Pittsburgh & Midway Coal Mining Co. at its Paradise Mine near Drakesboro, Ky. Trucks work 14½ hours a day over roads spotted with razor-sharp rock. For this tire-killing job the company uses B.F.Goodrich Rock Service tires with new Cut Protected (CP) compound, finds they last as much as 4,000 hours

on the original tread.

BFG developed CP compound rubber to defy rock cuts and snags. CP compound helps prevent premature tire failure that can send costs skyrocketing and production plummeting. Under this Rock Service tread is B.F.Goodrich Flex-Rite Nylon cord construction—twice as strong as conventional cords, ready and able to resist heat blowouts and flex breaks. Many users report Rock

Service tires can be retreaded over and over.

Take a tip from successful mine operators. Switch to B.F.Goodrich Rock Service tires with new CP compound (Heat Resistant or regular compounds, too). Your B.F.Goodrich dealer's tire know-how and service facilities will help you cut the cost of doing business. Look him up today under Tires in the Yellow Pages. The B.F.Goodrich Company, Akron 18, Ohio.

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

How planet-drive "25"

stripping ... ripping.

To make full-load turns, you simply change the speed of either TD-25 track with "live-track" Planet Power-steering. This way, you keep full power and traction on both tracks, full time. You get rid of load-limiting, profit-squeezing "dead-track drag."

To handle big offset loads, or to counteract the side draft of benching or highwalling, without sluing or bank-nosing, is finger-tip easy. Just shift the TD-25's load-side track to high range; leave the other track in low. You stay on course, deliver full loads or make full cuts under full power.

To keep full loads on the move, full time through tough or easy going, use instant-acting, on-the-go Hi-Lo power-shifting. Pit-to-hopper matching of power to condition helps "keep the heap"—extends effective dozing distances—cuts down on payload spillage. Fast, easy TD-25 power-shifting is a built-in bonus of Planet Power-steering!

And only the International TD-25 gives you the 230 hp wallop of the free-breathing, dual-

Doubling for dynamite—this TD-25 rips and breaks up a 30-inch vein of coal—to reduce cost of loading out with a 3-cu yd power shovel for Rice Brothers Coal Company, Phillipsburg, Pa. Power-on-both-tracks steering means "full speed ahead" with the ripper. The two TD-25's on this job team up with three draglines to move 25% of a 60-foot-deep overburden.

valved DT-817 diesel—with peak turbocharging efficiency at all altitudes.

Prove the profit advantage of full-load delivery, full time. See how consistently the TD-25 outproduces king-sized clutch-steered competitive rigs. Compare operating and upkeep economy, too. Let your International Construction Equipment Distributor demonstrate.



International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, III. A COMPLETE POWER PACKAGE

"Our International TD-25 doubles load delivery of regular 'dozer blade... using V-type blade on spoil leveling," reports Partner Carl Sartori, Willowbrook Mining Co., Slippery Rock, Pa. On-course steering with this heavy offset load is achieved by upshifting speed of load-side track—to put extra power leverage where needed.

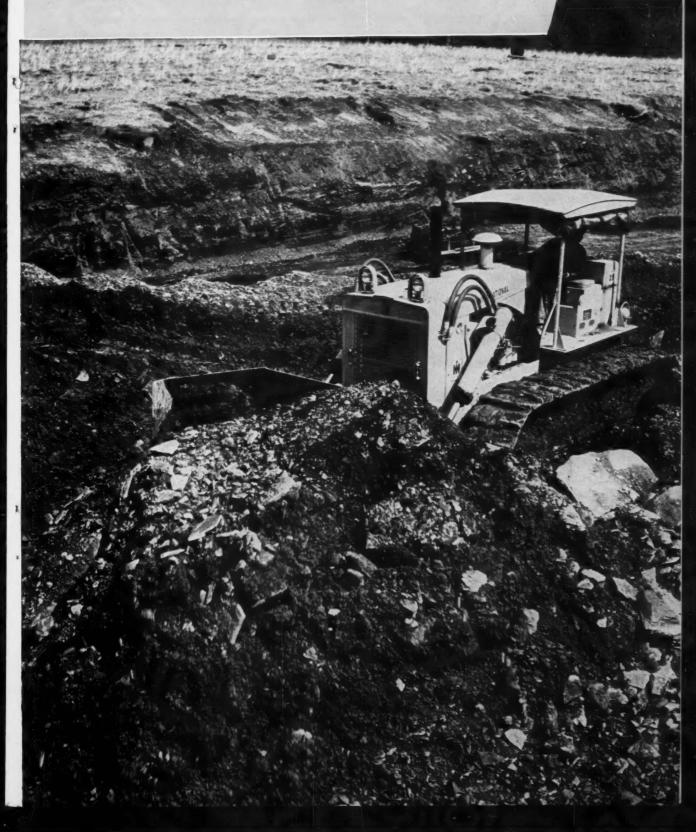
Pushes of over 600 feet pay off for Contractor C. R. Davis, Albuquerque, New Mexico—producing road gravel. Instant speed control of either or both tracks with the planetary transmission means positive load control—to heap the blade and "run" to the crusher. Then the "25's" high reverse of 7.5 mph means fast back-up for the next push. What would have been a costly two-tractor operation is efficiently done with one TD-25!

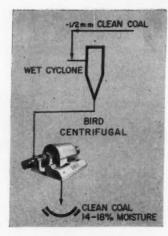




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You get DRIER COAL — consistently and substantially drier than you can obtain by vacuum filtration or any other mechanical means.

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This Month in



November, 1961

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Productivity

W. L. Wearly, Joy Mfg. Co.

What's Ahead in Productivity . . . and the Capital Problem p 56

Adequate financing is the key to research and development that can lead to equipment and methods providing the maximum in productivity and the minimum in cost in the future. But the capital-expenditure rate of the bituminous industry has dropped even faster than output in the past 10 yr, cutting sharply the flow of funds from which manufacturers must finance their work on new equipment. It is a problem that coal must face up to. The future will bring the continuous-process concept—or operation of plant 8,760 hr per yr instead of say, 3,000. "This new automatic pushbutton concept could well be the catalyst for another productivity breakthrough."

Deep Mining

p 78

p 82

p 88

High Production with

Conventional Equipment p 64

Deep- and punch-mining methods and conventional equipment net 16.6 tpm over the payroll at mines of North American Coal Corp., Laurel Fork mine, Mammoth, W. Va. Mobile type operation is employed because of hilltop seam location and also to overcome seam faulting. The system is not in its strictest sense punch mining, but it has all the characteristics on a somewhat larger scale than normal.

Company Success Policies—Ten rules which are in part responsible for the company's success.

Competition

Charles Hochgesang, Electrical World

The Gas Target for Today p 60

Though, with 1,116,000 home installations at the end of 1961, the electric-utility industry and its allies are "at the end of the beginning" in the sale of electric heating for homes, commercial operations and industry, the natural-gas industry has suddenly awakened to the threat to the business it has enjoyed. As a result, it is getting set to try to knock out electric heating and at the same time build an additional new market for itself. In line with this decision, it is going after air-conditioning. Needed by the utilities and their allies is a similar single-purpose nationally coordinated drive to sell electric heat.

Stripping

Reducing Blasting Noise Today p 72

New explosive usage techniques and evaluation of weather conditions are two useful tools for reducing blasting complaints at mines near populated areas. Airborne noise can be reduced by substituting low-energy detonating cord (LEDC) for conventional and using other components to make a Low-Noise Level Trunk Line Blasting System. A 150-ft length of the LEDC (Continued on p 7)

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WORLD'S LARGEST COAL LOADER LIFTS SEVENTEEN TONS WITH MUSCLES OF

Truax Traer Coal Company depends on Yellow Strand for extra strength and durability at Burning Star Mine #2

Truax Traer's "Little Dipper" at its DuQuoin, Illinois, mine handles more coal per bucket (14 cubic yards) than any other two-crawler loader fills a large Euclid wagon in 4 loads. Takes a lot of rope strength to handle such a load. Takes a lot of rope durability

to keep such a loader working, too. No wonder the wire rope choice was Yellow Strand-famous for its ability to cut downtime. Whatever your rope needs, depend on Yellow Strand to hold down costs. Depend on your Yellow Strand distributor for satisfaction.



BRODERICK & BASCOM ROPE CO. ST. LOUIS . PEORIA . HOUSTON . SEATTLE

THIS MONTH IN COAL AGE (Continued)

makes only about as much noise as one electric blasting cap or 2 in of reinforced detonating fuse. By studying wind velocity and temperature on the days when blasts are planned, operators can determine if the noise will be excessive. Blasting should be avoided when temperature inversions or isotherms prevail.



Electricity

Stanley E. McDowell, Allis-Chalmers Mfg. Co.

Selecting Protection

For Intermediate Voltage Service . p 78

The choice between fuses or circuit breakers for circuit protection depends upon the function of the circuit, its manner of installation, exposure to external hazards, such as lightning, and so on. Fuses are less complicated, but circuit breakers feed larger loads. Fuses are faster-

acting on short circuits, but generally slower than relays on overloads. However, both may be used in the same circuit for best results.

Maintenance Ideas

It is better to know exactly what caused a bearing failure and avoid another later than merely receive a new one free of charge. The ability to draw the right inferences from bearing failures is necessary. Recognition of this fact is essential if all the advantages of ball and roller bearings are to become realities. This article by SKF Industries, Inc., will help you understand the causes of bearing failures, and how and why these failures occur.

Coal Sampling

Laboratory sampler mounted on a pickup truck prepares coal samples in the field. The advantages of this unit are better control of coal quality, prepare more samples, obtain quick results from samples, reduce the amount of sample-tonnage hauled and lower cost per sample.

(Continued on p 9)

This Month in COAL

MORE STRENGTH—With 9-million-ton weeks beginning to show up again, the bituminous production rate began to exhibit more strength as the year went into its final weeks. The improved outlook is compounded of a continued rise in the steel rate, some additional improvement in the level of general business, and replenishment of stockpiles, which had continued their downward drift of several years' standing in the first 6 mo. Total for the year for bituminous? Still not likely to exceed 400 million, against 1960's 416 million.

Anthracite continued to hold its own extremely well and still has a good chance, with an assist from the weather, to equal the 1960 mark.

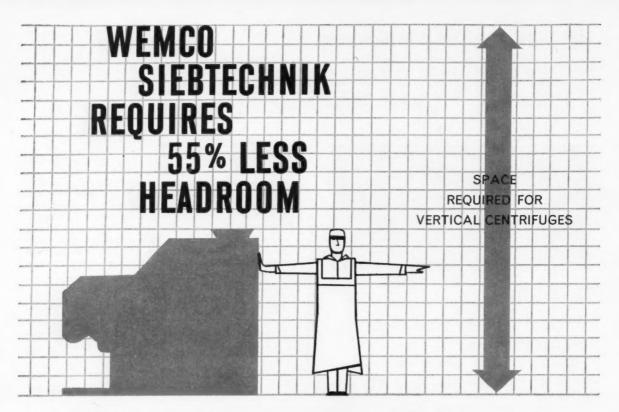
TARGET FOR GAS—As time goes on it becomes clearer and clearer that natural gas is pinning its hopes for the future on taking the air-conditioning market away from the electric utilities. It is a move almost of desperation since gas is looking down the utility gun barrel in the field of space heating—primarily residential but also to a growing extent commercial and industrial. But if it can break electricity's hold on summer cooling, it would encounter little difficulty in adding and keeping the heating load. Some real muscle—financial and otherwise—is being put behind a highly coordinated cooperative drive.

BLACK-BOX PROSPECTS—When coal considers its stake in the generation of electricity its needs must think about other possible sources of same. They include the home- or store-sized gas turbine or engine hooked to a

generator providing power while the exhaust provides heat. It is too early to tell if this one means trouble. The others include, in addition to coal's old friend, nuclear fission, such ideas as thermoelectric conversion, thermionic reactions, fuel cells and magnetohydrodynamics, or MHD. An expert on these and other black boxes sees no competition with the usual utility source of electricity for a long time to come, if ever.

\$100 BILLION COMING UP—Taxes are always with us, and so need not necessarily be a topic for any specific month. Nevertheless, it may be of interest if not a profit to take a look at what has happened in the first months of the present administration. Accelerated spending is it in a nutshell. In fact, it is expected that Kennedy will hit the \$100-billion-a-year level before his term is up—and go on from there if he is re-elected. Higher taxes, rather than lower, therefore are a distinct possibility, along with continued cheapening of the dollar.

ATTAINING 500 MILLION—Though for the moment the goal of the bituminous industry is attaining a market of 500 million tons, it goes without saying that the industry does not mean to stop there. But it is a start and the industry was preparing in September and October to put more beef into its effort in the form of strengthened research, public-relations and marketing operations. This beefing up was in turn considered only the first step, and the expectation was that more weight would be applied as business picks up.



...with superior operating performance!

Substantial space, operating savings

Only the Wemco Siebtechnik, today, makes possible such savings—in space, operating costs while proving superior dewatering performance.

Its unique horizontal design permits installation in low headroom areas (up to 60% less than with vertical design centrifuges) and allows easy access to all main working parts. Simplicity of design, special operating features make possible consistent, maximum production with maintenance and replacement costs at a minimum.

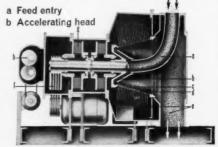
Power savings too: Competitive units require up to 60 HP to handle 50-60 T.P.H. (Dry Basis); The Wemco Siebtechnik requires only 20 HP to handle 100-120 T.P.H. (Dry Basis).

3000-hour basket life

Operators report over 3000 hours of operation before replacement of dewatering basket! Savings, too, due to minimum product degradation are substantial.

Coal or other material is conveyed through dewatering basket by vibratory action—without scrapers or spirals.

The unique operation of the Wemco Siebtechnik—HOW IT WORKS:



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- g Main mechanism and bearing housing
- h Vibrating action generated by adjustable eccentrics

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THIS MONTH IN COAL AGE (Continued)

Haulage

R. L. Houlton, General Electric Co.

Mine Haulage Automation p 94

Automation must pay its own way if it is to be a success. To attain economical operation of a mine, one of the purposes of automation may be increased manpower efficiency or an increase in tpm output. Beyond this, there are many other potential benefits of automation in industry that are more apt to justify automation than the increase in manpower efficiency, such as increased utilization of equipment, higher product quality, increased flexibility and reduced abuse of equipment.

Illustration Extras-Logic-flow diagrams of a haulage system.

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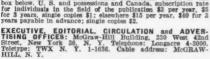
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THIS MONTH In Mining Practice

MORE SURFACE SAVING?-The fanfare that accompanied the signing of a coal-control bill into law in Pennsylvania by Governor Lawrence in September possibly should give coal men pause to think even though the law applies only to anthracite. But if it sticks it could set a precedent for similar legislation elsewhere, putting all types of local governments into mining regulation with its attendant headaches. Though it may not be the complete answer, proper pillaring could help materially. Regularity, complete removal of stumps and, as far as possible, no long shutdowns still remain as key items in reducing surface disturbance and damage.

SELLING METHANE-Since it can be accepted that methane drainage by boreholes either from the surface or ahead of the face will be a growing practice, the question comes up as to whether any money can be realized by methane sale. Some 84 British mines are now in the business, and the West Midlands area alone, sold 263,000 MCF in the first 6 mo of 1961. At West Virginia and Pennsylvania wells the present realization is as much as 30¢ per M. which would mean that the West Midlands sales would have brought \$78,000. Hardly a source of great wealth but if drainage was necessary for other reasons some offsetting revenue might be anticipated.

COAL NEED TOO?-A recent COAL AGE editorial visit to a new electric generating plant found officials lamenting the lack of a means of determining immediately the moisture and ash contents of coal on a conveyor belt feeding the boiler bunkers. "Quick" determination of moisture and ash, meaning several minutes or more, now is possible with equipment already available. Perhaps, however, something more nearly approaching instantaneous should be sought for more vigorously not only for the consumer but also the producer.

"LINEAR" MOTORS-The possibilities of motors of this type in driving conveyors have been sufficient to induce the National Coal Board of Great Britain to sponsor some research. In such motors, the belt itself is made of conducting material and constitutes the "rotor" of the induction motor, continuously moving through the fields rather than turning. Much greater belt "contact" area, compared to the conventional pulley, is one advantage cited for this new concept in providing conveyor power.

UNDERGROUND GASIFICATION—Renewed interest has been noted in the idea of burning coal under controlled conditions underground, thereby turning it into a gas for direct consumption or further processing to grade it up to pipeline quality. The work both in the U. S. and abroad has shown that the idea, though it looks easy at first glance, isn't. But changes in both practice and economics could alter the situation and make such a gas source economically attractive. However, underground gasification admittedly is not likely to challenge present mechanical methods in the relatively near future.

Long-Airdox face preparation team sets fast pace for high-capacity mining systems

LRB-7 ROOF BOLTING MACHINE

— high-speed operation, fast
tramming, unusual maneuverability.

Here is how to have faster face preparation and higher production with lower costs—regardless of seam height. Take advantage of the superior speed and flexibility of this unique Long-Airdox face preparation team . . .

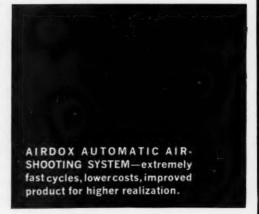
LRB-7 ROOF BOLTER. The most versatile and powerful machine of its type. Offers highest torque and thrust; most effective internal, throughsteel dust collector; fast easy operation; low-maintenance hydraulic system.

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AUTOMATIC AIRDOX SHOOTING. Faster than any other system and gives better product. Lighter weight automatic discharge tubes; sequence shooting of any number of holes in a single operation; and single-unit TDF drilling, multiple-shooting machine (which transports tubes and sequence valves) now make this system practical and economical for all conventional mining.

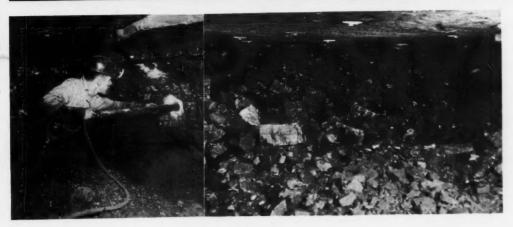
For facts and figures, write Long-Airdox, Oak Hill, West Virginia.

TDF MOBILE DRILLING MA-CHINE — drills full depth holes at outstanding speeds.









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THIS IS MSA: Illumination • Electronic Communication and Control • Rock Dusting and Dust Collecting • Fire Fighting Equipment • Respiratory Protection • Artificial Respiration Equipment • Personal Protective Wear • First Aid Equipment • Permanent and Portable Instruments

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MINE SAFETY APPLIANCES COMPANY





This man... is running this locomotive

There is no one in the locomotive. The man in the picture can speed up, slow down, stop or reverse this train, whether he is riding the locomotive or walking, or standing on the ground. Both he and the locomotive are equipped with a new Union Switch & Signal remote control system for industrial switching locomotives. Because the operator always can be at the best vantage point, blind operations are eliminated and cars are spotted for loading, unloading or dumping more efficiently. This man can put a car precisely where he wants it.

You can minimize the hazards involved as freight moves around your plant with this unique remote control system. If you have a special problem such as moving cars into a thawing pit or under a loading chute, use a centrally located console control unit so one man has complete control over the entire operation.

Look over your in-plant locomotive operation and see if it couldn't be made safer and more efficient if the man running the train could always see what he was doing. Check the coupon for our illustrated Bulletin 187 on how our remote control systems can work for you.

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90 feet of overburden was blasted away at this site to expose the seam of bituminous coal, which has been removed. For top efficiency and economy, this Alabama

operator uses a mixture of Spencer N-IV ammonium nitrate and 6% No. 2 diesel fuel oil to break up the overburden.

Spencer AN/FO blasts away overburden ... helps Alabama stripper cut costs



Blasting superintendent Virgil Phillips pours a charge of Spencer N-IV and 6% No. 2 fuel oil into a blast hole. A half pound of AN/FO will remove an average cubic yard of overburden.



Hard sandstone and shale overburden is pulverized by the blast. This 17-yard shovel then exposes the seam 90-feet below the surface.

Low-cost N-IV Ammonium Nitrate/fuel oil mixture provides top blast efficiency

The Robbins Coal Company of Oneonta, Alabama, has been successfully strip mining a seam of coal that lies under 90 feet of hard sandstone and shale. To break up this overburden, they rely on Spencer N-IV Ammonium Nitrate/fuel oil mixture. Less expensive than dynamite, the Spencer AN/FO is easy to handle, safe to store.

Current procedures call for a series of 40-foot holes nine inches in diameter. Holes are spaced in rectangles of 25 x 27 feet. Each is filled with 500 lbs. of the Spencer N-IV/fuel oil mixture. An average blow will set off a series of 32 holes. After blasting, a large shovel clears the overburden.

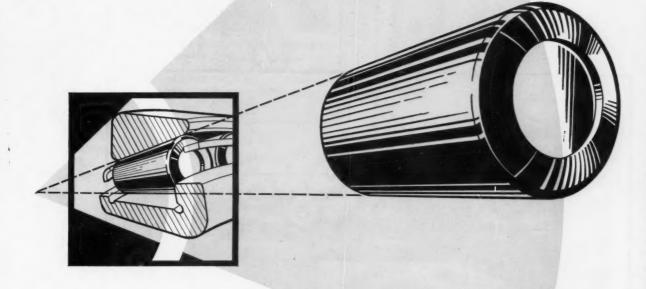
No secondary blasting is needed because Spencer N-IV/fuel oil mixture gives such excellent fragmentation. This superior blast is the result of the special prill structure of N-IV which absorbs oil more easily, and the extra high percentage of ammonium nitrate in the compound.

For complete application data on Spencer N-IV, write Spencer Chemical Company, Industrial Chemicals Division, 407 Dwight Building, Kansas City 5, Missouri.

SPENCER CHEMICAL COMPANY



Dwight Bldg., Kansas City 5, Mo.



What Bower does to roller heads to give tapered bearings longer life

The spherical head design shown above is part of what we call "Spher-O-Hone". It simply means that Bower tapered roller bearings perform better, last longer.

Bower grinds roller heads with a spherical radius. This assures accurate roller alignment, which eliminates sliding and skewing. An "O" shaped groove is provided at the base of the cone flange for positive roller head lubrication. And the cone raceway and flange face are honed precisely.

These further lessen friction, thus reducing wear.

This is typical of the attention paid to details in design and manufacture by Bower engineers. And to you this attention can mean faster schedules, less downtime and greater profit from each job because Bower bearings handle maximum capacity loads and last longer.

When you need tapered or straight roller bearings of any type or size, be sure to specify Bower.



BOWER ROLLER BEARINGS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. . DETROIT 13, MICH.



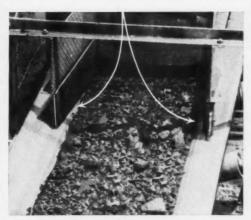
AT THE HEART OF INDUSTRY ...



Coal crosses a river on a 3,870-foot <u>US</u> Conveyer Belt at Jones & Laughlin's La Belle, Pa., preparation plant, one of the world's largest. The <u>US</u> Belt, supported by the world's longest belt-conveyor bridge, has been carrying run-of-mine coal since 1948 without a breakdown. In this time it has carried over 50 million tons of coal.

CB 106

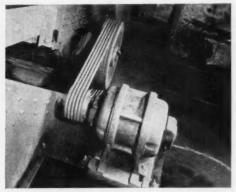
Wherever the coal industry operates, you'll find <u>US</u> Industrial Rubber Products and engineers helping automate the mining, handling, and utilization of coal, making it the economical energy producer it is.



No more spilling or gouging when your conveyors are protected by U.S. Royalite® Skirt Boards. These Skirt Boards won't groove conveyor belt covers or pick up abrasive materials and moisture. Used at loading points, they center the load, insure proper training, prevent uneven belt wear, add years of life to belts.

SK 101





Known for maximum reliability, safety, and profit, U.S. Royal V-Belts provide top efficiency, exceptional length stability, uniformity and long service life on all types of drives. You'll profit from the driving power of U.S. Royal V-Belts on conveyor, elevator, and loading-boom equipment; crushers, breakers, dryers and pumps; ventilator and cooling fans.

The first perfected interwoven coal mine belt, the

The first perfected interwoven coal mine belt, the U.S. Burro® Conveyor Belt is tough all the way through, is safe, is fire resistant. Besides exclusive engineered stretch control, this belt has the widest operating temperature range, highest edge and lengthwise rip resistance, assures perfect troughability, and...is low in cost.

1 .

For every industrial rubber product need, turn to <u>US</u>. For Conveyor Belts, V-Belts, the original PowerGrip "Timing" Belt, Flexible Couplings, Mountings, Fenders, Hose and Packings... custom-designed rubber products of every de-

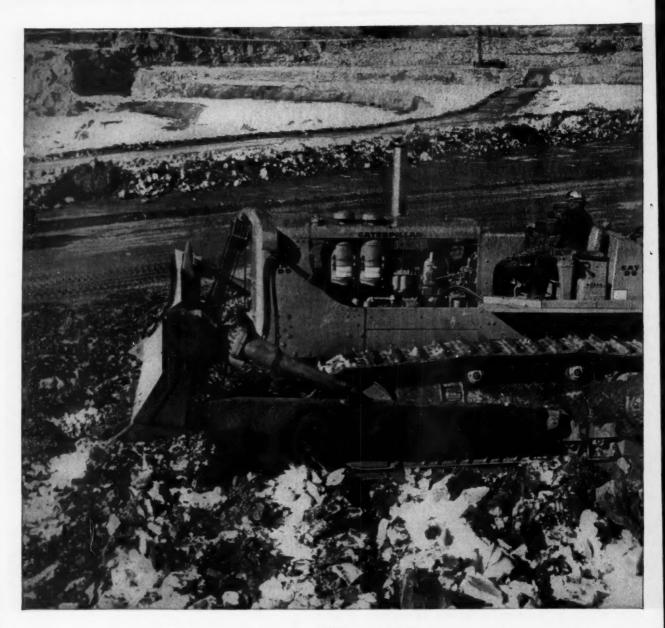
scription. Discover why U.S. Rubber has become the largest developer and producer of industrial rubber products in the world. See your U.S. Rubber Distributor or contact <u>US</u> directly at Rockefeller Center, New York 20, N. Y.

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS



United States Rubber

MECHANICAL GOODS DIVISION



If you're blasting rippable material, your money's going up in smoke

Mining operations are getting quieter. The reason is that more and more owners are replacing expensive blasting of ore and overburden with relatively inexpensive ripping.

The silence will never be complete, of course. Some material is simply not rippable, even with the brute strength of the big Caterpillar D9E Tractor. But where material is rippable, it is considerably cheaper to rip than to drill and blast. Simple arithmetic supplies the most important reason. Add up these costs: power source, compressor, drills, drill bits, labor and supervision for drill and powder crews, dynamite truck, powder and primer, insurance, access roads and benching for drilling equipment. Then compare the total with the

owning and operating cost of a ripping tractor.

And there are other cost-saving advantages in ripping:

1. Ripped pieces of material tend to be smaller than blasted pieces, which means easier, faster handling and increased production. The spacing, depth and direction of ripping passes can be varied to obtain the desired size pieces, eliminating



HOW RIPPING WITH A D9E SOLVED A DIFFICULT AND UNUSUAL MINING PROBLEM

Mining of the main deposit had been completed at a uranium mine—but an excess of 50,000 tons of commercial grade ore still remained in scattered lenticular deposits around the bottom of the pit. They varied in depth from two to six feet, some occupying areas as great as 1000 square feet.

Problem: how to mine them economically.

Blasting would have been uneconomical since the commercial grade ore would have been diluted with surrounding low-grade ore and waste material. Shovel excavation without prior shattering would have been extremely slow, if possible at all.

Engineers suggested trying a tractor-mounted ripper. Tests indicated that this was the answer, and mine supervisors ordered a Caterpillar D9E Tractor with power shift transmission. Attachments included a No. 9 Ripper with two teeth and a No. 9S Bulldozer with tilt cylinder to give added prying action in digging out ore chunks

in the more heavily consolidated portions of the formation.

The material is first ripped to a depth of 28 inches on 4-foot centers. Then it is cross-ripped (shown in photo at left) to break the heavily consolidated ore into easily handled pieces for shovel loading. The D9E bulldozes the pieces into a pile for loading into hauling units. Ripping and bulldozing production averages from 300 to 500 cu. yd. per hour. In addition the D9E handles road maintenance.

No other machine is as well suited to this kind of rugged mining work as the D9E. With 335 HP (flywheel) and a massive, long-lived undercarriage, it has the power and stamina to do the job. But, more important, it can do the job at reasonable cost. For the D9E's rugged construction and dependable Cat Engine mean that it stays on the job hour after hour, day after day, doing the work you bought it for.

Talk over your ore and overburden removal problems with your Caterpillar Dealer. If it is his best judgment that Cat-built equipment is the answer—he's ready to prove it to you with a demonstration.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

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expensive and time-consuming secondary blasting.

2. Ripping is safer than blasting. And in many cases this can mean lower liability insurance rates.

 A ripping tractor offers the extra dividend of availability for various bulldozing jobs when it has completed its ripping assignments.

All told, the savings can be quite considerable. In fact, it is a rule of thumb that a ripping tractor used on a production basis can loosen ore and overburden for one-third to one-half the cost of drilling and blasting. In many cases, savings even top that. For example, on the Mesabi

Range rock was ripped with D9s for 10% of the cost of drilling and blasting.

The chart below gives some ex-

amples of typical savings. All are actual cases where Caterpillar tracktype Tractors with rippers replaced drilling and blasting.

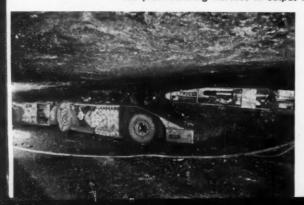
LOCATION	MATERIAL	Ripping Costs (Cents/Cu. Yd.)	Drilling and Blasting Costs (Cents/Cu. Yd.)
Tulsa, Oklahoma	Limestone	7.3	17.3
Dallas, Texas	Limestone	5.2	15.1
San Francisco, Calif.	Sandstone	15.0	30.0
Merriam, Kansas	Sandstone	2.1	11.7
Nelsonville, Ohio	Sandstone	5.7	13.8
Philadelphia, Pa.	Limestone	11.5	19.3
Carbo, Virginia	Sandstone	8.6	15.7
Hibbing, Minn.	Frost	25.0	60.0
Hibbing, Minn.	Paint Rock	6.1	54.5

Seanor Coal jumps production with Joy's new loader-shuttle car team

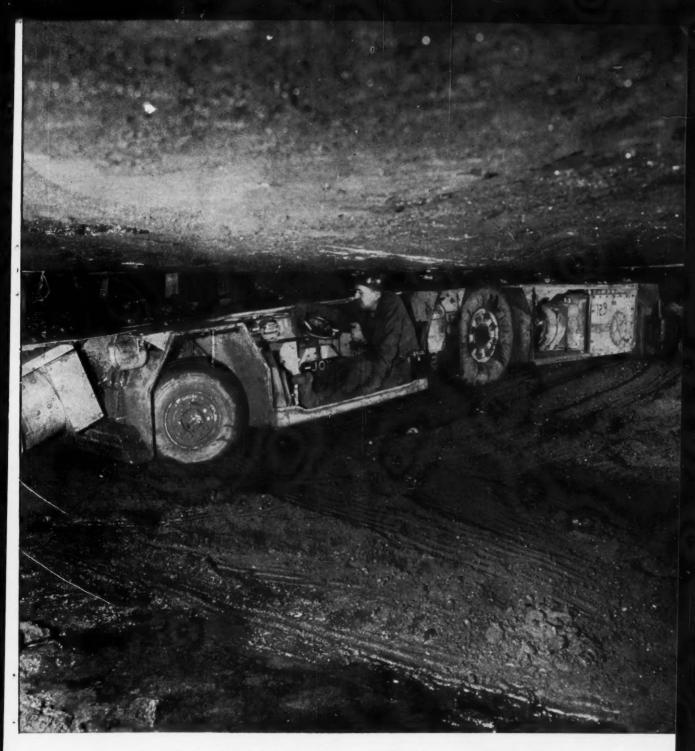
The Seanor Mine of Simpson Coal & Chemical Corp. has been modernized with 18-SC Shuttle Cars and 14BU-10 Loaders—Joy's new high production team for low and medium-low seams. In the 43" seam, the six-wheeled Joy 18-SC buggies give far greater haulage capacity than conventional cars because of their ability to bend on the dips and rolls. The maneuverability of the 18-SC's gives faster trip times, in addition to the extra capacity. New Joy 14BU-10 Loaders are used to take full advantage of this big haulage capacity. Shift in—shift out, this team maintains Seanor Coal's output at a high rate. Ask your Joy representative for complete details on Joy's new high capacity, low cost team.



Four ton load of the 18-SC's, and the fast time of the 14BU-10's has provided a big increase in output for the Seanor Mine,







Six-wheel design of the Joy 18-SC Shuttle Car enables it to take dips and rolls without topping. Operators like the safe comfortable ride between the wheels—take full advantage of the car's speed.



WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING MACHINERY



Coat Drills



Coal Cutters



Shuttle Cars



Joy Manufacturing Compar

Joy Manufacturing Company Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario



TIGER ON THE SPOT AT PEABODY COAL COMPANY

USS) Tiger Brand drag ropes average 750 hours in rugged service

This 32-cubic-yard dragline operates around the clock digging overburden at Peabody's Airline Mine, near Linton, Indiana. It is rigged with a pair of 25%" USS Tiger Brand drag ropes 275 feet long. These are subject to severe abrasion and heavy shock loads . . . but they last from 700 to 800 hours.

The Tiger Brand hoist ropes last up to 1800 hours. These are 21/8" in diameter and 477 feet long, designed to meet the specific requirements of this service.

Whatever the equipment—whatever the purpose—you'll find USS Tiger Brand Wire Rope designed to meet your most exacting requirements. It's a top-quality product. Specified standards are maintained for every step of production. Plant facilities are unsurpassed in the industry. These facilities, along with one of the finest staffs of wire rope engineers in the country, assure wire rope with complete dependability, long service life and maximum economy.

Put the Tiger on the spot! Where you have a large variety of wire rope applications, the Tiger Brand Field Service Representative can be of great help. Call him in to make a check of your equipment. The chances are he can save you money. His services can be obtained through your local Tiger Brand distributor or by writing direct to American Steel and Wire, Dept. 1460, Rockefeller Building, Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks



American Steel and Wire Division of United States Steel

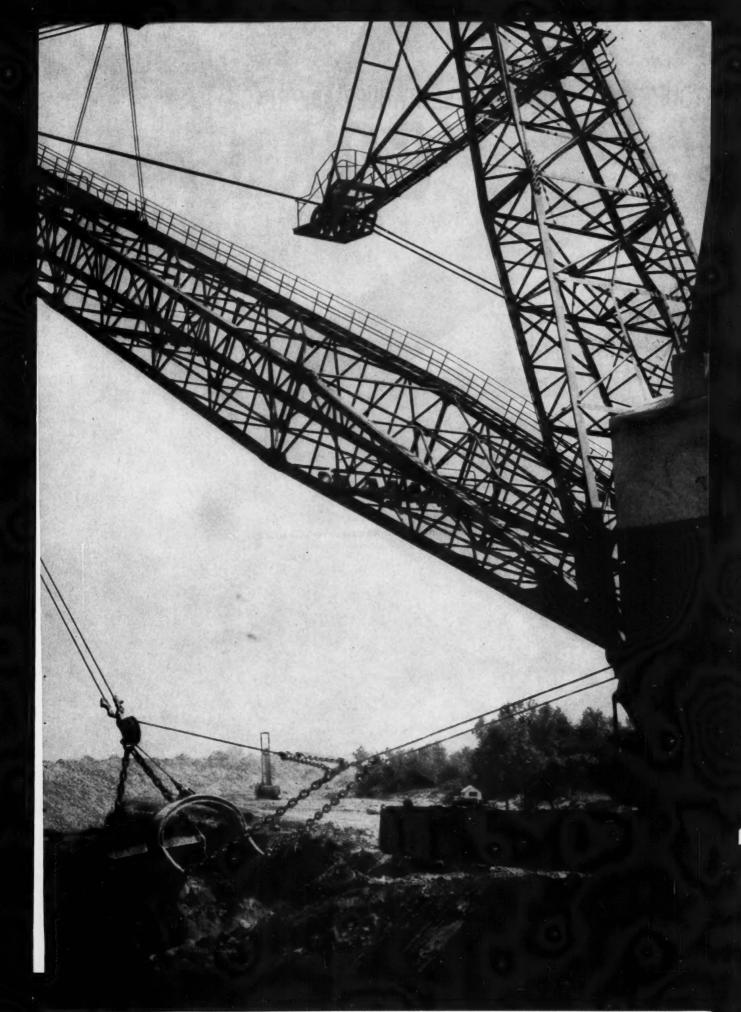
Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors Tennessee Coal & Iron Division, Fairfield, Alabama, Southern Distributors United States Steel Export Company, Distributors Abroad



USS Tiger Brand 2%" diameter drag rope provides a good balance of resistance to abrasion and bending fatigue.



Blast hole drill rigged with USS Tiger Brand % " hoist line and % " pull-down line for maximum service.



YOUR



REPRESENTATIVES ARE READY

"COAL

HERE'S HOW THE "COAL CADDY" **KEEPS TONNAGE..**

UP TO PAR!

- 1. Conveyor Flights with the advantages of rugged alloy steel construction, without the disadvantages of increased weight.
- 2. Flight attachment is positive and insures rigidity without the annealing effect of welding.
- 3. Generous diameter of through hardened alloy steel flight pins for long pin life.
- 4. Tapered or reversible straight design, the right conveyor flight for your machine.
- 5. Universal Links with extra strong,

extra heavy male and female members. Large diameter connecting pins give full pivot freedom.

- 6. Connecting Links have extra heavy side straps to resist wear.
- 7. Large diameter hard chrome plated 14" pins maximize link life.
- 8. Attaching Side Straps sized after heat treatment for perfect fit under all conditions.
- 9. Block Links feature one-piece design and are forged from high physical alloy steel.

TO INTRODUCE THE ...

CADDY"

HERE'S WHY YOU NEED A "COAL CADDY" ON YOUR LINKS!

Proven design is only part of the story. Proven performance makes the difference. And what a difference! The "Coal Caddy" stays on the job to keep tonnage high, maintenance low and reduce downtime. Designed for the job, the "Caddy" carries the load efficiently. Built for rugged duty,

the "Caddy" carries the load longer. There's a "Coal Caddy" for Joy 14 BU and 20 BU loading machines, Jeffrey 81 Series loading machines, and Lee-Norse continuous miners. Chains of similar construction and identical dependability are available to fit other Joy, Jeffrey and Lee-Norse machines.

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J. Schonthal & Associates, Inc. 224 South Michigan Avenue Chicago 4, Illinois Phone: Wabash 2-8350

R. M. Wilson 27 Oak Park Avenue Wheeling, W. Va. Phone: Chapel 2-1052

Mechanical Mining Service P.O. Box 503 Morgantown, W. Va. Phone: Linden 2-5522

Wenzel Parts Service 1050 N. Canal St. Carlsbad, New Mexico Phone: Tuxedo 5-4222

A. M. Gardner 626 Park Lane Greensburg, Pennsylvania Phone: Temple 4-4346

Ralph B. Moore Inc. 3847 Forest Street Denver 7, Colorado Phone: Dudley 8-3691

Centact your nearest representative teday, or write us direct for information about the "Ceal Caddy" and other high quality, efficient replacement parts.

MINING MACHINE PARTS, INC.

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News Roundup



J. R. Garvey
"The research department can develop
the equipment needed to compete in the
non-power heat energy market."



"We have a public relations and advertising program that we are convinced will help us attain a 500-million-ton market."



W. W. Bayfield

". . . we need to aggressively sell the advantages of burning coal the modern way."

500 Million Tons Per Year: Goal of NCA Program

An annual bituminous coal production of 500 million tons per year is the goal of a National Coal Association program aimed at capturing new coal customers in the non-power heat market—a market representing thousands of fuel users who operate small—or medium-size boiler plants or use heat directly in manufacturing processes.

On Sept. 29 the association presented details of the plan first submitted to the NCA convention last June. Means of financing the research, public relations and marketing aspects of the program will be studied by NCA's finance and executive committees which will offer a plan at the next board meeting in December. NCA President Stephen F. Dunn estimated that the program will cost a maximum of \$587,000 in 1962, and less than that if supplemented by help from the U. S. Office of Coal Research and by market survey reports from coal industry sales personnel.

Three-Fold Plan

At the heart of the plan is a research program to develop improved combustion equipment which would make coal fully competitive in this market. James R. Garvey, NCA director and vice president of Bituminous Coal Research, Inc., said BCR's efforts would include development of equipment to produce gas from coal without the tars which often



Stephen F. Dunn
"We see in this program a real challenge,
a very real opportunity for industry improvement."

make trouble in present equipment. "Accelerated research and the establishment of an equipment servicing organization," he said, "will enable a start on the road to achieving more coal sales in the non-power heat energy market."

A detailed advertising and public relations program to inform potential customers of the advantages of coal when consumed with modern equipment was revealed by Rex Chaney, NCA director of public relations. In explaining how this would be accomplished, he said: "As one very effective means of transmitting our message to prospective coal buyers, we have designed a modest advertising program aimed directly at fuel purchasers in the markets we are trying to capture. The messages we propose to use will cost less than 5ϕ per reader—less than the cost of preparing and mailing one letter. No better or more economical method has yet been devised to reach prospective customers."

Plans for an aggressive marketing program to capitalize on the research and public relations drives by face-to-face selling of coal's advantages were presented by W. W. Bayfield, NCA vice president-marketing. Mr. Bayfield pro-

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Special report to users of Caterpillar D7, D8 and D9 Tractors:



New Piston and Ring Combination Cuts Oil Consumption 33-50% ... Lasts Hundreds of Hours Longer!

4-RING DESIGN



NEW 3-RING DESIGN



What makes it so different? Look at the two Caterpillar-made pistons. Notice in the new design that both compression rings are now deeply seated in grooved cast iron (indicated in yellow) instead of only the top ring. Since cast iron is able to resist groove "pound out," both compression rings are held firmly longer in the correct position for maximum ring-to-liner sealing. Compression loss and blow-by behind rings and around grooves is delayed hundreds of hours, too.

The new intermediate compression ring is a "twist" ring, so-called because it changes position in the groove during the power stroke. It actually "twists" so its face has greater sealing area at the liner than regular rings—reducing the number of compression rings normally required. At the same time, it thins the film of oil left by the regular oil

control ring. This leaves less oil to burn away which contributes to the new piston's better oil control and longer ring life.

All rings now have a new look, too ... each and every face is thickly chrome plated against wear. They are also "bright lapped" to such brilliance that any flaws can be easily seen and the faulty ring rejected. Such quality control assures almost perfect seating right from the start, eliminating break-in blow-by, slobbering and scuffing.

Cost? Pistons with the extra cast iron bands cost slightly more, but ring sets are less! Once you change over, your tractor maintains its power longer, your fuel and oil bills go down, and your next set of replacement rings will be less. Your Caterpillar Dealer has them in stock now.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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Diesel Engines • Tractors • Motor Graders • Earthmoving Equipment

posed a market research program to locate customers, obtain closer cooperation with equipment makers and plan for financing and servicing coal equipment. Market promotion for coal, he said, can best be done by joint action, plus the cooperation of progressive retailers.

Concluding the presentation, Mr. Dunn emphasized that other industries have successfully carried on similar programs through their trade associations. "We must continue to press our case in Congress, before administrative agencies of the government, in public forums and wherever else it may be necessary for us to fight," he declared.

Coal Constitutes 68% Of U.S. Mineral Reserves

New, detailed, conservative estimates of recoverable reserves of mineral fuels in the U.S. appearing in the Interior Department's latest Geological Survey report show that coal constitutes 68% of the total. Petroleum and natural gas account for 16% of the fossil fuel reserves, and oil from oil shale makes up the remaining 16%.

As of Jan. 1, 1960, the estimated recoverable coal reserves of this Nation totaled 830 billion tons. Of this huge tonnage, some 1,442 times the recent annual production, 47% is bituminous, 25.5% is sub-bituminous, 26% is lignite and 1.5% is anthracite and semi-athracite. Even assuming a great increase in the rate of coal production, these reserves will last for many generations.

Of the 830 billion tons of recoverable reserves, available data suggest that about 25% is measured or indicated reserves in beds 28 in or more thick and less than 2,000 ft below the surface. This fraction corresponds roughly to coal of present economic interest.

Four states contain just half the Nation's reserves. They are North Dakota, Montana, Illinois and Wyoming (in decreasing order of tonnage). About 60% of the reserves of higher-rank bituminous and anthracite is found east of the Mississippi River. Illinois and West Virginia together contain 254 billion tons or about 31% of total bituminous reserves. Pennsylvania has 88% of the anthracite, or 22,805 million tons. The 60% of reserves west of the Mississippi River is mostly of low rank.

"Coal Reserves of the United States—A Progress Report, January 1, 1960," by Paul Averitt, has been published as U.S. Geological Survey Bulletin 1136. Copies can be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 26, D. C., for 50c. The report includes tables showing total reserves by states and by rank of coal, and a text discussing reserves in individual states. Accompanying illustrations include a map showing coal fields

Fuels Planning

Speaking at an oil and gas industry meeting in Washington, Oct. 3, Assistant Interior Secretary John M. Kelly called attention to the worsening international situation and expressed his intention to establish within the Interior Department a fuels and energy study which will parallel the study being conducted by the Senate Interior Committee. Its purpose, he said, will be to assist the committee in accomplishing its task and "at the same time place the Executive Branch in a position to move intelligently to the adoption of integrated policies in this vital field."

To assure "the adequacy of our future resource base," he continued, "we are taking a careful look at such elements of Federal policy as research, the leasing laws, the conservation laws and the tax laws as they affect energy production and use. . . ."

The fuels industries, Mr. Kelly declared, would be among the first to be mobilized in the event of a new national emergency. He stated the resumption of Soviet nuclear testing and the erection of a concrete curtain between East and West Berlin have "brought a new and more immediate awareness of our energy responsibilities, both in Government and in industry."

Calling for heightened awareness that our energy interests transcend our national boundaries, Mr. Kelly cited the recent emergence of Soviet oil as an important factor in international trade. "We must provide for greater staff coordination, improved transmission of information and increased understanding of mutual interaction between resource policy and foreign policy," he declared.

Meanwhile, the already-approved Senate Interior . . .

Fuels Study Committee Is Naming Participants

The Senate Interior Committee scheduled to conduct the national fuels policy study, authorized Sept. 11 by the Senate, is rapidly completing its selection of participants.

In addition to appointing Senators Randolph (D-W. Va.), Engle (D-Cal.) and Cotton (R-N.H.) as ex-officio members, the committee has also chosen a number of specialists to aid in the study. Already selected are Dr. Charles J. Potter, president, Rochester & Pittsburgh Coal Co., to represent the coal industry; Herbert Bickel, Texas Eastern Transmission Corp. official, to represent gas; and John Ryan, Humble Oil & Refining Co. official, to serve oil.

Sam Lasky, assistant director of the Office of Coal Research, is on loan to the committee from the Interior Department and is currently gathering data on coal, gas and oil. It was indicated by a committee source, however, that it is not likely that public hearings will be held until next year.

of the U.S.; diagrams showing the overall distribution of coal reserves in various categories and the percentage of total energy supplied by coal and competing mineral fuels in the period 1900 to 1958; and tables showing the relation of coal reserves of the U.S. to reserves of other mineral fuels and to coal reserves of other countries.

N&W Ry. Plans Expanded Coal Piers— More Hopper Cars

The Norfolk & Western Railway has decided to double the capacity of its Lambert's Point coal pier (Coal Age, Jan. 1961, p 26) at Norfolk Va. This decision, said Stuart T. Saunders, N&W president, was reached after estimates of future coal requirements were raised.

Total cost of the pier and its supporting facilities now will be over \$25 million. Under the new plan, the maximum dumping rate of the pier will be boosted

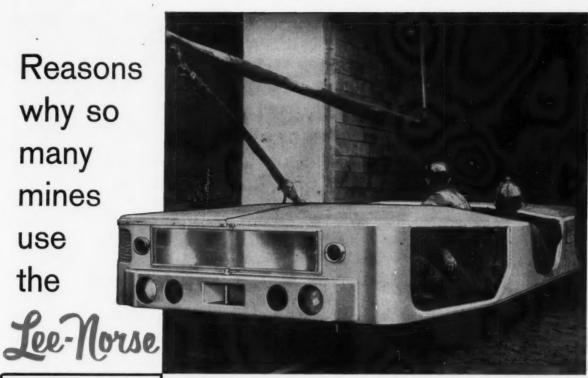
from 10,000 to 20,000 tph and the average or continuous rating for the pier will be increased from 8,000 to 16,000 tph. Two instead of one traveling ship loaders to be constructed will be capable of loading two 45,000-ton colliers simultaneously or work together on a single

Mr. Saunders also announced a third order for 1,000 85-ton coal hopper cars to be built in the road's Roanoke, Va., shops. These cars, of original N&W design, have roller-bearing wheels of 36-in diameter—3 in larger than standard. Production of the \$12 million project will begin around Jan. 1 when the present order of 1,000 cars is completed.

Plans Would Revive Military Oil Board

Interior Secretary Udall's recentlydisclosed plans to re-establish the Military Petroleum Advisory Board was unwelcome news to the bi-partisan Con-(Continued on p 32)

Reasons why so many mines use the



ne po

- FAST—Cuts portal to portal time as much as 50%.
- STREAMLINED-Transports 11 to 13 men in safety and comfort in low seams.
- SAFETY—Exclusive split-roof allows operator full directional vision—trolley pole easily reached. Quick acting hydraulic trucktype brakes on each axle and on the traction gearmotor. Independent mechanical hand parking brake each axle.
- POWERFUL—Self-propelled by sturdy traction-type 15 HP gearmotor (250 or 550V-DC).
- RUGGED—Quality built to withstand the hard usage of 'round the clock mining!
- 6 LOW MAINTENANCE—Simple design—easy accessibility.
- OPTIONAL FEATURE—Electric dynamic brakes for plus safety on severe grades.





Lee-Norse Company

CHARLEROI, PENNSYLVANIA Specialists in Coal Mining Equipment

People in Coal



R&P President Chosen to Represent Coal in Fuels Study

Consolidation Coal Co.'s Hanna Coal Co. Div. has appointed Evan Adams general superintendent of Ireland mine to succeed Clyde Gibson who has been named general superintendent of underground mines. Mr. Adams, who had been maintenance superintendent at Ireland since 1959, joined Hanna in 1942 as a maintenance foreman. Since then he advanced to master mechanic at Piney Fork No. 1 Mine in 1943, assistant superintendent in 1950 and superintendent in 1951. He then moved to Willow Grove No. 10 Mine as general superintendent in 1953 and became field maintenance engineer at the general office in 1955.

H. B. Brown Jr. has assumed the duties of associate director—legislative, National Coal Association Dept. of Government Relations, succeeding John Jex who resigned to become assistant vice president, New York Life Insurance Co. Mr. Brown, an associate director since last April when the department was reorganized, joined NCA in 1950. His work will be primarily on the Senate side of the Capitol. Former Rep. Carter Manasco will continue to represent NCA in matters affecting the House.

Virginia Polytechnic Institute has announced the joint appointment of Ronald M. Coiner as instructor in the Department of Mining Engineering and the Virginia Engineering Experiment Station.

Born on July 16, 1908 in Greenfield, Mo., he now resides in Indiana, Pa., with his wife and three children. His first formal education was provided by the School of Mines and Metalurgy, University of Missouri, from which he graduated in 1929. A year later he received his Master's Degree in chemical engineering from the same institution. He received a Ph.D. Degree from West Virginia University in 1932 and was awarded an Honorary Doctor of Science Degree in Engineering by the University of Missouri in 1950.

DR. CHARLES JACKSON POTTER, affectionately called "Doe" by his many friends in the industry, has been chosen to represent the coal industry on the staff of the Senate Interior Committee in its investigation of a national fuels policy. Presently serving his 14th consecutive term as president of Rochester & Pittsburgh Coal Co., Dr. Potter is also a member of the General Technical Advisory Committee of the Office of

His employment with Rochester & Pittsburgh Coal Co. began in 1940 and was interrupted for a period during World War II when he served with the U.S. Interior Department as Deputy Coal Mines Administrator and Deputy Solid Fuels Administrator. For his efforts during this time, he was awarded the Medal of Merit by the President of the United States, and Honorary Commander Most Excellent Order of the British Empire.

In addition to being president and a director of Vitro Minerals Corp., Dr. Potter is also a director of Vitro Corp. of America, United Eastern Coal Sales Corp., Rochester & Pittsburgh Coal Co. (Canada) Ltd. and the American Mining Congress.

In addition to his teaching duties at VPI, Mr. Coiner will also be engaged in research in coal preparation and mineral beneficiation. A native of Covington, Va., he attended Greenbrier Military School, Lewisburg, W. Va.; Morris Harvey College, Charleston, W. Va.; and graduated from VPI in mining engineering this year.

Robert L. Llewellyn, manager of preparation, Eastern Gas & Fuel Associates, will visit three European countries to inspect a new X-ray device which analyzes the ash content of coal prior to its installation in a new Eastern plant. Called the "Cendrex ash meter," the Dutch-developed instrument will be a major factor in the preparation of steam coal, for power and general industrial applications. Its installation late this year at Eastern's Federal preparation plant at Grant Town, W. Va., will mark the first time it will be used in a U. S. preparation plant. Mr. Llewellyn will view the device in operation in England, The Netherlands and France.

Associations

The Smokeless Operators Association has named W. W. Walker, president, to succeed Austin Caperton. Mr. Walker is president of Ashland Mining Corp.,

while Mr. Caperton is president, Slab Fork Coal Co. Other officers elected are: W. A. Haslam, president, Winding Gulf Coals Inc., first vice president; Peter P. Ferretti, president, Pocahontas Fuel Corp., second vice president; Albert S. Kemper Jr., president, Premier Pocahontas Co., treasurer; and James B. Wooldridge Jr., secretary.

The Central Pennsylvania Open Pit Mining Association reelected the following officers Sept. 18 in Philipsburg, Pa.: Ralph G. Kuhns of Philipsburg, chairman; H. Rembrandt Woolridge of Clearfield, president; R. S. Walker of Bigler, secretary; and Arthur Rydberg of Kylertown, treasurer. Robert Bailey of Morrisdale who had been elected vice president was killed in an automobile accident Sept. 24 (See Obituary p 40).

The Joint Annual Meeting of the Central Pennsylvania Coal Producers' Association and Eastern Bituminous Coal Association took place Sept. 21 at the Bedford Springs Hotel, Bedford, Pa. R. T. Todhunter Jr., president, Barnes & Tucker Co., was elected president of the two groups and a director of each. Other officers elected were John W. Krous and Clarence A. Dobson, vice presidents and directors of each group; Robert T. Laing, secretary and treasurer; C. P. O'Neill, assistant treasurer; (Continued on p 40)



Step up tonnage, cut costs, reduce inventories . . . with Sunoco 740-A EP lubricant and Suntac 502, one of the many Sun job-fitted hydraulic oils. Sunoco 740-A EP clings like grease, pours like oil. It is water and heat resistant . . . gives excellent rust and corrosion protection . . . won't thin down under severe service. And it meets all daily underground

requirements, except your hydraulic needs. Pioneering of this basic lube program by Sunoco even sparked development, in conjunction with a leading equipment manufacturer, of the well-known two-output pump shown above. It can be used, with a product like 740-A EP, to fill gear cases at high volume or on pressure fittings at high pressure.

Why SUNOCO for your 2-product underground lube program?



Because: you get the product quality it takes to meet all your daily needs at the face . . . job-fitted by men who developed the simplified lube program . . . backed by the service you have a right to expect. Get squared away on real savings. See your Sunoco man . . . or write to Sun Oil Company, Philadelphia 3, Pa., Dept. CA-11, In Canada: Sun Oil Company Limited, Toronto and Montreal.

PIONEERING PETROLEUM PROGRESS FOR 75 YEARS

gressional group which, a month earlier, urged substitution of a board representing all fuels. (Coal Age, Oct., 1961, p86)

The petroleum board, which was designed to advise and assist the Departments of Defense and the Interior in assuring petroleum supplies for vital national needs, had been deactiviated several years ago when the Department of Justice questioned its propriety under the antitrust laws. Mr. Udall said the new group would be set up in such a way as to avoid these objections.

Coal Pipeline Bill Dies in Pa. Senate

All hopes for progress toward transportation of coal by pipeline in Pennsylvania died with the bill authorizing it in the Senate State Government Committee with final adjournment of the legislature.

Under rules of the Pennsylvania legislature, the measure does not automatically remain in the Senate Committee during the interim between sessions. And since the 1962 session is limited to fiscal and budgetary legislation, it will have to be reintroduced as a new bill at the next general session in 1963.

Although the measure had previously passed the House with only four votes to spare, its chances of passage in the Senate were considered dim. The railroad lobby is strongest in the Senate where Republicans hold a veto power over the final passage of legislation. Trucking interests also dished out strong opposition to the bill.

Oil transmission companies, on the other hand, were reportedly backing the bill with the intent of building a coal pipeline from the southwestern Pennsylvania bituminous area to the eastern seaboard power markets.

Largest Steam Unit Ordered By Utility

The electric power industry hailed recently a development that was said to parallel in importance the first breaking of the sound barrier in the field of aviation.

Consolidated Edison Co. of New York, Inc. announced that it had ordered from Allis-Chalmers Mfg. Co. a steam turbine generator with a capacity in excess of 1 million kw. This marks the first time that the 1-million-kw level has been breached. According to Consolidated Edison spokesmen, the new unit scheduled to come on line early in 1966, would use coal or oil as fuel—the choice to be determined by existing fuel costs.

Harland C. Forbes, Chairman, said that for utilities large enough to absorb such great blocks of power as such machines represented there would be "substantial savings in investment costs per kilowatt of power."

Area-Wide Gas Rates Proposed by FPC

The Federal Power Commission opened hearings Oct. 11 on its proposal to substitute uniform, area-wide rates for gas producers instead of conducting lengthy rate hearings for each producer. Fruition of this proposal should not only assist in disposing of the enormous accumulation of unsolved rate cases which resulted from the former method of rate determination, but should also prevent a recurrence of such a backlog.

Gas producers, of course, do not ap-

Coming Meetings

Kentucky Mining Institute, Nov. 9-10, 1961—Phoenix Hotel, Lexington, Ky.

Coal Division Conference, American Mining Congress, Nov. 17, 1961

—Penn-Sheraton Hotel, Pittsburgh, Pa.

Fuels Div., ASME Annual Meeting, Nov. 26-30, 1961 — Statler Hilton Hotel, New York, N. Y.

Mechanization of Mines in India-Symposium and Equipment Exhibition, Dec. 9-22, 1961-Central Mining Research Station, Dhanbad, India. Delegates from ten countries will participate in the symposium which will run from Dec. 9-12 and view the mining machinery and equipment exhibition which will continue until Dec. 22. Papers to be presented include 24 on winning, methods of work and detailed operations; 12 on transport; eight on ventilation, blasting and allied subjects; 12 on supports and roof control; and 12 on safety and control. Those intending to participate should immediately register their names with the Hon. Secretary, Mechanization of Mines Symposium, c/o Journal of Mines, Metals and Fuels, 6/2, Madan St., Calcutta-13 (Cable: TEKJOURN, CALCUTTA).

Coal Mining Institute of America, 75th Annual Meeting, Dec. 14-15, 1961 — Penn-Sheraton Hotel, Pittsburgh, Pa.

AIME Annual Meeting, Feb. 18-22, 1962 — Statler-Hilton Hotel, New York, N. Y.

1962 Coal Convention, American Mining Congress, May 6-9, 1962— Pittsburgh, Pa.

prove of the new method because lower wellhead prices would cut into their profits. They argue low reserves and inability to find supplies adequate to meet increased demand unless prices are more attractive. On the other side of the fence is the industry's trade association representing pipeliners and distributors. L. J. Potter, head of the American Gas Association, praised the new system and said: "Ultimate reserves of sufficient magnitude for the nation's needs beyond the year 2000 await only the incentive for their development by the gas industry as proved reserves." He noted that FPC endorsed the new formula only as a partial standard for pricing gas.

Under area pricing, a fixed price would be used as the ceiling for natural gas within certain defined areas. Rates that are set below the ceiling could be accepted with minimum rate proceedings while those above the level would be subjected to hearings. As a guideline, the FPC suggested a ceiling rate of 16¢ for production on new contracts and 11¢ for old production. Joseph C. Swidler, new FPC chairman, strongly endorsed the

new area-rate system of producer prices but said such rates must be ceiling, not floor or norms. In spite of some controversy within the industry as to whether actual legislation is required to effect the system, Chairman Swidler said no new legislation is necessary to help FPC.

BCR Awarded Contract For Fine Coal Study

Bituminous Coal Research, Inc. recently was awarded a \$142,900 contract by the Office of Coal Research to study the preparation, transportation and utilization of super-fine pulverized coal. Interior Secretary Stewart L. Udall, in making the announcement, said the contract seeks "an economical method whereby pulverized coal can leave the mine and be used in plants and factories in self-contained, continuous systems, eliminating storage and disposal operations."

Specific contract objectives are to develop systems for preparing pulverized coal with the removal of sulfur and ash, continuous transportation from mine to factory, and designing and operating boilers to burn superfine coal efficiently in continuous sequence with transportation systems. In addition, the contract calls for study of superfine coal as a raw material in gasification, carbonization and similar methods.

New Contract Bracket Set Up by TVA

To bridge the gap between short and long term contracts, the Tennessee Val-(Continued on p 45)



Let your H-R power transmission specialist show you how to select the right chain to fit your power drive or materials conveying needs, at "off-the-shelf" savings.

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Plants grow better beside water

That's because an abundance of water is necessary for plant life. And those that have their roots at the water's edge can devote full attention to the problems of productivity.

Since 1953, more than 3,000 new plants have located on the Mississippi River System alone, not to mention the Great Lakes, the Gulf and numerous other rivers. Why? Mostly it is a matter of the "cost of living." Process water and plant utilities can be obtained economically; raw materials and finished products can be moved in and out at low cost.

If you are considering a waterside location, or plan to expand or modernize an existing plant, you are invited to call on Dravo's 60 years' experience in and around water. Work has been performed for the U.S. Army Corps of Engineers in every one of the past 60 years, including many lock and dam projects in the continuing program for improvement of the country's inland waterways system. Another activity is production and marketing of river sand and gravel. Hundreds of industrial plants are served by Dravo-built docks. Ships and barges laden with ore, coal, bauxite and other bulk cargo are unloaded by Dravo materials handling equipment.

Pumphouses and water intakes, water and waste treatment facilities, steam or power generating plants, fabricated piping are also company specialties. Towboats, tugboats and barges launched at the Pittsburgh or Wilmington shipyards move almost every type of water-borne commodity. A subsidiary, Union Barge Line, offers common-carrier and contract transportation service on the Mississippi River System and Gulf Intracoastal Waterway.

The coupon can be used to obtain more information on these activities.

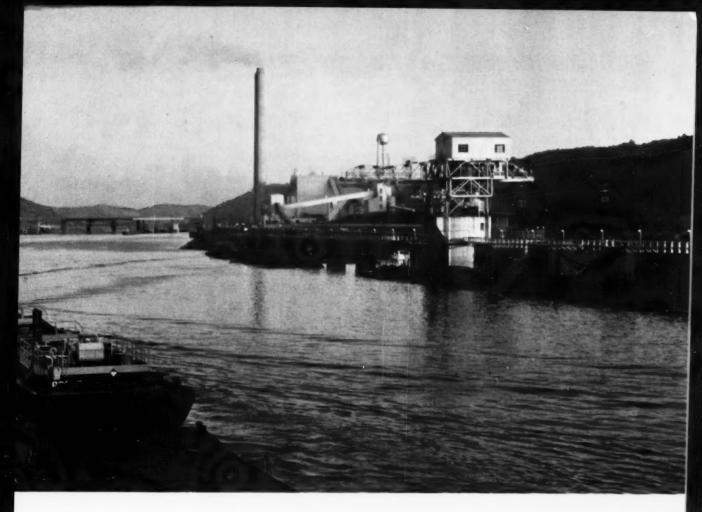




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Twin high-speed river towboats built for a New Orleans transportation company.





A Union Barge Line tow carries products of many industries.



Generating station, dock and unloader built on turn-key basis.



A covered hopper barge is launched at Neville Island shipyard.

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Mount Firestone Super Rock Grip Deep Tread tires on your coal trucks—and watch downtime take a licking. The only tread design of its kind, this tire's 50% deeper tread is made of Firestone Rubber-X, tough enough to fight off cuts and bruises in the ruggedest off-highway going. And, because this tough tread rubber extends through to the cord, you get a wearing-base bonus in recaps.

Its Shock-Fortified nylon cord body, too, staves off schedule-disrupting impact breaks. For unbeatable on-the-job tire service—and coal-carrying tires—see the man at your nearby Firestone Dealer or Store.





Always Specify Firestone Tires When Ordering New Equipment

Coal Abroad

ECSC Revises Forecast

In a revised forecast, the High Authority of the European Coal & Steel Community now predicts hard coal production in its six member countries will amount to 59.3 million tons during the last quarter of 1961, 0.6 million tons less than during the corresponding period of 1960. Imports are predicted to increase from 4.56 million tons to 5.5 and pithead stocks are expected to amount to 36.4 million tons by year's end.

Conditions in Britain

Britain has had three coal plans since the war. The first two proved very wide of the mark and the last one, which it was felt had been adjusted in accordance with what now seemed likely, also promises to share the same fate. This is due to the drift of miners to other industries. Over the first half of this year alone 29,-000 miners left the pits.

Insufficient new production to satisfy demand has forced Britain to take 6,817,000 tons from its accumulated stocks. Actual production of deep and strip coal as of Sept. 2 dropped to about 125 million tons from 129 million last year. Although consumption in the electrical industry increased 2,500,000 tons as of Aug. 31 over last year, less coal was used elsewhere. The overall national internal consumption in the first 8 mo totaled about 124 million tons as against 129 million last year.

Oil competition remains as severe as ever but the coal industry still supplies over 70% of the country's power needs.

Overseas Flashes

INDIA-Thompson-Starrett's Roberts & Schaefer division has signed a \$4,106,-000 contract with state-owned Hindustan Steel to supply equipment and machinery for its Patherdih washery, one of three new coal washeries to be set up in the third 5-yr plan period. The Patherdih washery will produce 1,300,000 tons of washed coal annually at the rate of 400 tph. It is located in Dhanbad district (Bihar) where the Mechanization of Mines in India symposium and equipment exhibition will take place in Dec. (See Meetings, p 32). This \$8,000,000 washery will be followed by a second at Dugda (Bihar) with a \$6,000,000 credit from the Export-Import Bank.

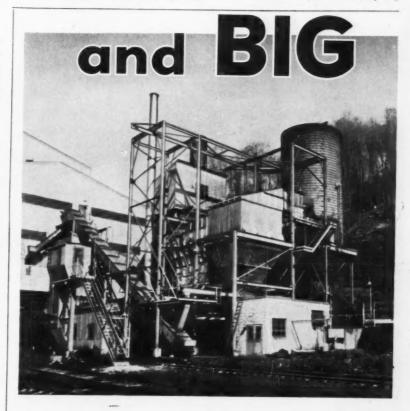
Coal produced in 1960-61 totaled some 55 million tons—a 33% increase from 1956-57. The 1965 production target has been set at 97 million tons. To achieve this goal, New Delhi, having profited from the 2nd plan experience of

country-wide coal shortage, has sanctioned the expansion programs of private collieries which—until last year—were not permitted to exploit in adjacent areas.

POLAND—Pipelining of coal has now spread to Poland where great reductions were achieved in a recent trial run. A hydraulies pipeline, designed by the Polish Central Mining Institute, is reported to have successfully carried coal up to 50 mm in size over a distance of 124 mi. In comparison with rail shipment.

transport costs were reduced by 50-65% and capital expenditure by 80%.

JAPAN—This small but progressive country is not overlooking ways and means of expanding her coal industry. In late September the Coal Industry Council, an advisory committee to the Ministry of International Trade & Industry, announced modernization measures aimed at reducing the production cost of coal by \$3.60 per ton for fiscal 1963. By that time, coal output will be limited to 55 million tons a year. Production cost in 1960 was \$12.50 per ton. This rather ambitious program will involve action in five direction of the continued on p. 49)



THE H&P FLUID BED DRYER

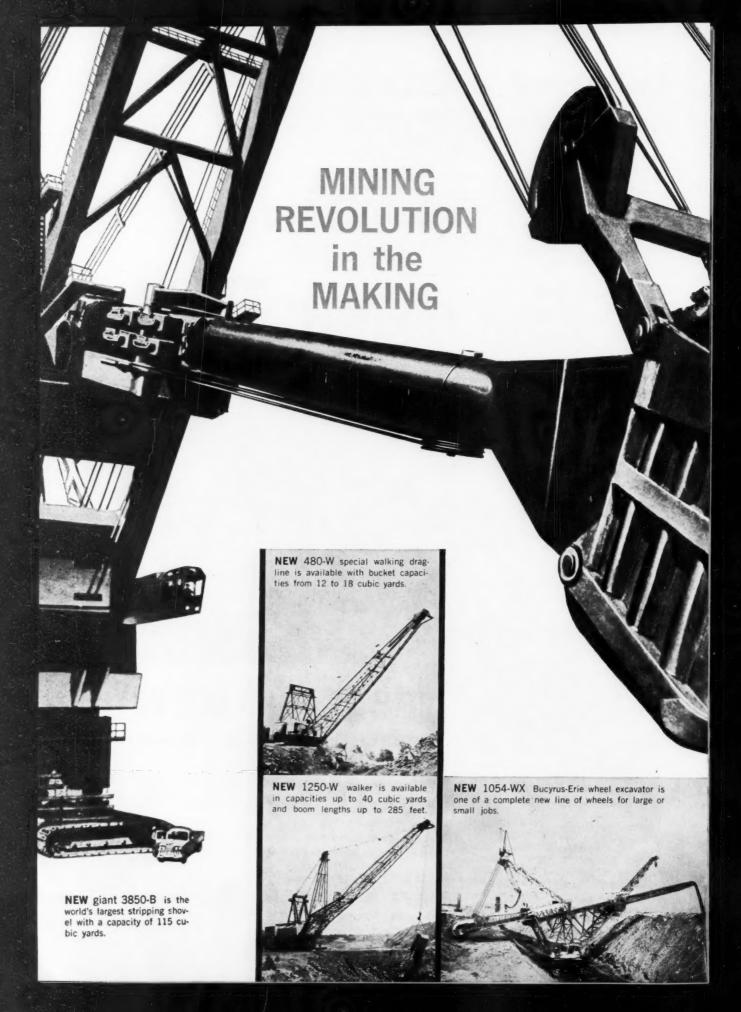
14 H & P Fluid Bed Dryers are now in successful operation or under construction. This represents 2760 TPH total capacity.

H & P Fluid Bed Dryers range from 70 to 480 TPH; evaporation rates are from 5.5 to 33 TPH. They perform well on coal in the $1\frac{1}{2}$ " x 0 range, with outstanding results on difficult Centrifuge and Filter Cake mixtures.

For truly superior performance, select the H & P Fluid Bed Dryer. Phone or write for further information and request Brochure 159.

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Bucyrus-Erie invests in the future of coal!



Leading the way to new production economies is a whole new lineup of Bucyrus-Erie machines ... machines that bring you a new concept for mining efficiency. What you see here are *only a few* of many Bucyrus-Erie developments that help producers increase output and lower costs per ton more than ever before ... new stripping shovels with capacities never before known ... and a line of large-to-small wheel excavators.

When you look for new production economies, you are invited to consult with the only company in the world qualified to objectively recommend and sell any size, any type of shovel, dragline, wheel or drill. Bucyrus-Erie Company, South Milwaukee, Wisconsin. 4161





NEW 30-RP blast hole drill, like all Bucyrus-Erie drills is backed by the finest service in the industry.



NEW 210-B is available as dragline, stripping shovel or coal loader from 7 to 12 cubic yards . . . with electric or diesel-electric power.



NEW 270-B has capacities from

8 to 18 yards . . . this model has

100-ft boom, 58-ft handle, 8-yd

heavy-duty dipper, with crawlers of

NEW 1850-B is a new stripping shovel now being designed for a major coal producer . . . capacity: 90 cu. yd.



People (Cont'd from p 30)

and Frank G. Smith, general counsel. In addition the following were elected directors of the Central Pennsylvania organization: T. L. Aitken, Charles B. Baton, Otes Bennett, Heath S. Clark, A. B. Crichton Jr., H. John Harper, Donald E. Hartman, John K. Mc-Carthy, W. J. B. Mayo, Ralph E. Moore, Harold K. Powell, Joseph E. Smith, J. D. Sutton, John S. Todhunter, Frank P. Waggett and Whitney Warner Jr. Other Bituminous Coal directors include Heath S. Clark, Matthew A. Crawford, A. R. Davidson, Sam Light, John Barnes Mull, George E. Owen, R. S. Walker, Whitney Warner Jr., R. W. Wigton Sr., and Harold D. Woolridge.

Following the general meeting in the

afternoon, talks were given by M. W. A. Edwards, business economist of the Bituminous Coal Operators' Association, who gave a resume of National legislation and Mr. John W. Krous, president, Imperial Coal Corp., who gave a report on air-pollution regulations. At the banquet in the evening Joseph E. Moody, president, National Coal Policy Conference, Inc., was guest speaker.

Obituaries

Robert Bailey, 64, president of the Bailey Coal Co., was killed in an automobile accident Sept. 24 near Phillipsburg, Pa. Mr. Bailey had recently been reelected vice president, Central Pennsylvania Open Pit Mining Association.

Fred W. Whiteside, charter member and secretary treasurer of the Rocky Mountain Coal Mining Institute for 40 yr, died Sept. 10 in Denver, Colo. He was 85. His widow, Mrs. Augusta Whiteside, who for 35 yr assisted him with his association duties, has been elected by the institute to fill the unexpired term. Mr. Whiteside was an engineer member of the State Board of Coal Mine Officials for many years.

J. A. Lewis, retired mining executive, died Sept. 11 in an Orlando, Fla., hospital after a lengthy illness. Mr. Lewis was formerly general superintendent of Winding Gulf Colliery Co. mines in Raleigh and Wyoming counties, W. Va. After retiring in 1954, he made his home in DeLand, Fla.

Dollar for dollar in cost of cutting, Bowdil Bits OUTPERFORM all others.

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Equipment Approvals

Lee-Norse Co. — Model CM68-1E continuous miner; three motors, each 75-hp, 440-V, AC. Approval 2F-1677A, Sept. 7.

Long-Airdox Co. — Type MBC-24L mobile bridge conveyor; one motor, 25-hp, 240-Y, DC. Approval 2F-1678, Sept. 11.

J. H. Fletcher & Co.—Type DM boom-type roof drill with integral dust-collecting system; one motor, 25hp, 415-V, AC. Approvals 2F-1679A and 25B-94, Sept. 11.

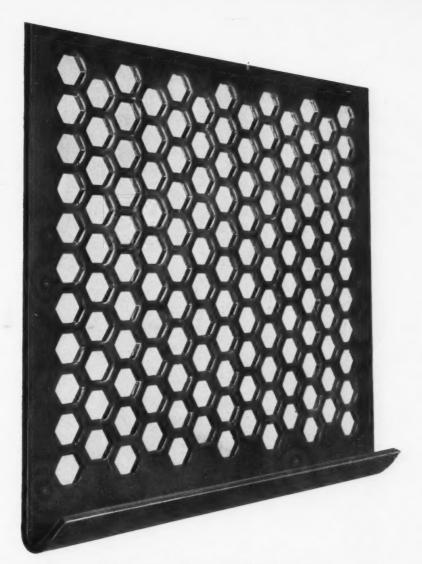
Long-Airdox Co.—Type LRB-7 roofbolting machine with integral dustcollecting system; one motor, 5-hp, 230-V, DC. Approvals 2F-1680 and 25B-95, Sept. 11.

Long-Airdox Co. — Type TDF-10 mobile face drill; one motor, 10-hp, 220- /440-V, AC. Approvals 2F-1681 and 2F-1681A, Sept. 13.

Long-Airdox Co.—Type PT-218 and PT-220 piggyback conveyors; two motors, each 5-hp, 240-V, DC. Approval 2F-1682, Sept. 14.

Jeffrey Mfg. Co.—Type MM-100-L miner with 94-D or L conveyor; three motors, one 50-hp and 2-hp, 440-V, AC. Approval 2F-1683A, Sept. 18.

Wise Coal & Coke Co.—Type WCC mobile bridge conveyor; one motor, 20-hp, 440-V, AC. Approval 2F-1684A, Sept. 26.



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Hendrick perforated metal screens are manufactured under the most rigid quality-control specifications. Their precision perforations are clear cut and uniform . . . assure continued screening uniformity . . . eliminate blinding. And with Hendrick perforated plates you can screen coal faster because their larger open area permits better draining . . . deck changes are also made faster—you save on downtime and labor costs. Hendrick quality steel perforated plate is made from high carbon or heat treated steels. It is available either flat or corrugated in any desired shape and with perforations of any size. Furnished with standard

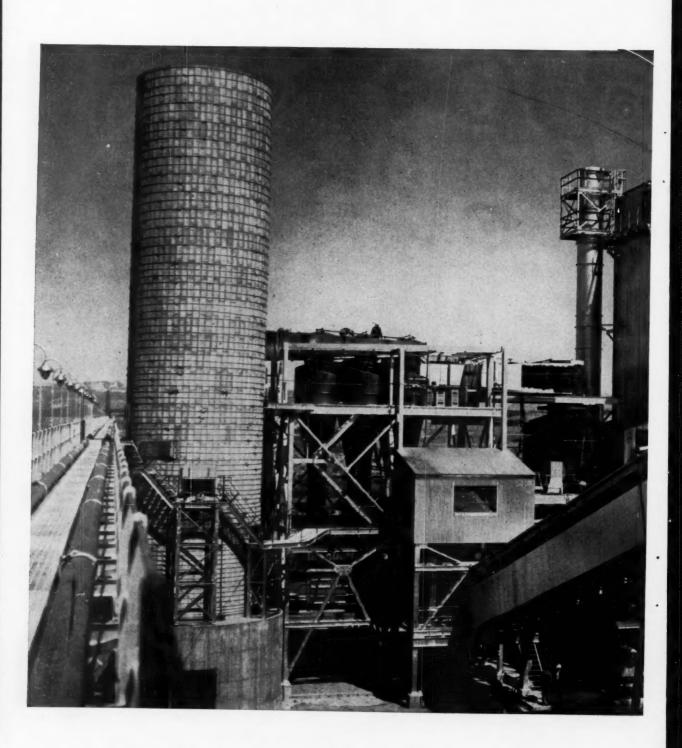
hook flanges for easy attachment to any vibrator. For more details, mail in the attached coupon today!



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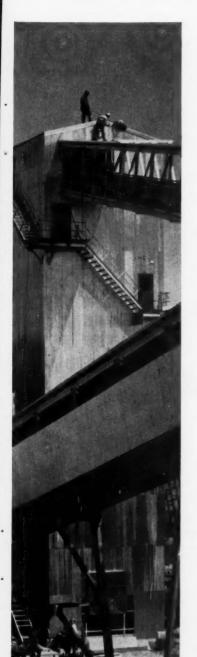
USS

Columbia-Geneva Steel Division

selects

FluoSolids® drying

at major coal preparation facility



The FluoSolids dryer placed on stream in mid 1960 at the United States Steel Corporation's giant new coal preparation facility at Wellington, Utah marked the second major USS installation to select this most advanced drying technique. The new unit followed the successful operation of two 14' I.D. dryers at a major East Coast coal preparation plant.

Located adjacent to the ten story high structure in the foreground, the FluoSolids Dryer at Wellington is removing 25 tph of water from 800 tph of $1\frac{1}{2}$ " x 0 metallurgical coal destined for steel making at Geneva Works near Provo, Utah.

First introduced by Dorr-Oliver in 1954, FluoSolids has enjoyed phenomenal success and has caused a revolution in thermal drying of coal. And the basic simplicity and efficiency has remained unchallenged to date.

The compact, unitized design conserves space, simplifies operation and realizes maximum use of heating BTUs. Burning pulverized coal automatically extracted from the

drying compartment, the FluoSolids system provides rapid start-up and shut-down . . . no fuel is consumed during shut-down as with banked stokers. Control is accurate and automatic and quickly responds to varying feed conditions. Hot air supplied to the drying compartment is pressurized, no exhaust fans being needed to handle hot, dirty gases. Uniform product control is assured through automatic feed rate adjustment and temperature control. Positive humidity control conditions give uniform drying. Compared with other systems. lower air volumes are required with corresponding savings in horse-

Applicable to a wide variety of tonnages and feed sizes ranging from filter cake on up to 1½ x 0 coal, the Dorrco FluoSolids system is the most advanced equipment available to meet today's demands for automation and efficiency in economical preparation plant operation. For complete information, write Dorr-Oliver Incorporated, Stamford, Connecticut.



Should you take permissible dynamites with a grain of salt?



We say <u>yes</u>, but not just a grain of salt: for increased safety all your permissibles should contain 10 per cent of salt!

After 2,400 shots in their test gallery, the U.S. Bureau of Mines concluded "that permissible explosives with salt additives are safer and that fine salt is more effective than coarse salt."

The salt has a remarkable cooling effect on the flames emitted by the explosives, thus lessening their chances of igniting gas or coal dust.

That's why every stick of permissible dynamite you buy from Du Pont contains 10% fine salt. We've been making it that way since 1958, and we are the only company to offer you a complete line of permissibles with this safety bonus.

It's easy to get this extra protection. You have a selection of 15 Du Pont permissibles to choose from - one of which will readily meet your particular underground problems - and the strongest Technical Service organization in the industry. Let us show you what this combination can do in your mine.

Call your Du Pont Explosives representative or distributor, or write: Du Pont, Explosives Department, 2444 Nemours Building, Wilmington 98, Delaware.

PROPERTIES OF DUPONT PERMISSIBLE DYNAMITES

Grade	Ctgs. per 50 lb. 11/4" x 8"(1)	t. per sec.(2)	Water Resistance	Fume Class(4)
"Duobel" A	135	9.200	Fair	A
"Duobel" B	150	9.000	Fair	A
"Duobel" C	165	8.500	Fair	A
"Duobel" D	185	8.000	Poor	A
"Duobel" E	205	7,500	Poor	A
"Monobel" AA	120	9.000	Good	A
"Monobel" A	135	7.400	Poor	AAA
"Monobel" B	150	7.000	Poor	A
"Monobel" C	165	6.500	Poor	AB
"Monobel" D	185	6.200	Poor	В
"Monobel" E	205	6,000	Poor	В
"Lump Coal"	118(5)	5.800	Poor	A
"Lump Coat"		5.700	Poor	A
"Gelobel" AA	102	16,500(3)	Excellen	
"Gelobel" C	120	12,100	Good	A

EXPLOSIVES



Better Things for Better Living ... through Chemistry

News (Cont'd from p 32)

ley Authority has set up, on a trial basis, an intermediate bracket of coal purchases which should benefit small and medium sized mines by providing more flexibility.

The new contracts call for a delivery period of not less than 8 wk and not more than 20 wk, with a minimum total quantity of 5,000 tons. Bids must offer at least 300 tons a week. Until now, TVA bought coal under two types of contracts. Spot contracts limited delivery to not over 4 wk with no minimum quantity specified, while term contracts covered deliveries extending for periods in excess of 6 mo with a minimum quantity specified in each letting.

The first bids under the new system were received Oct. 11 in Chattanooga, Tenn., for a maximum of 15,000 tons a week for the Shawnee, Johnsonville, Gallatin, Colbert and Widows Creek steam plants. If the intermediate contracts prove desirable after trial, they will be extended to other plants, TVA said.

Improved Blast Furnace Cuts Costs

Among modern iron makers finding new ways to increase output and cut costs in the blast furnace, is Jones & Laughlin Steel Corp.

Contracts for a new blast furnace, designed to take advantage of recent developments in ore preparation and in furnace operation for J&L's Cleveland

Works, have been awarded to Koppers Co., Inc., Pittsburgh. Avery C. Adams, J&L's board chairman, said the new furnace—largest in Cleveland—would give the company a sufficient hot metal supply for operation of the new basic oxygen steelmaking furnaces at their maximum utilization, thereby realizing full advantage of the reduced costs of basic oxygen furnace operations.

One important innovation will be the use of high-capacity burners fired in multiples in the blast-furnace stoves. "This hitherto unrevealed J&L development will provide higher blast temperatures without the massive stove construction previously required," Mr. Adams said. Other unusual cost-reducing features include: (1) A stock house and charging system which will be completely conveyorized. This feature, which replaces the larry cars, will speed up charging of the furnace. (2) A conveyor system which will carry raw materials from the unloading facilities a distance of 700 ft directly over two railroad systems to the blast furnace. Construction will start immediately, Mr. Adams stated, and the furnace is scheduled to go into operation early

Pa. To Update Mine Laws

Pennsylvania's Gov. David L. Lawrence has signed what he terms "a long-overdue" act setting up a seven-member commission to overhaul Pennsylvania's anthracite mining laws.

Three representatives from labor, three

from industry and the state's secretary of mines will make up the new commission which will modernize present laws regulating anthracite deep-coal mining; strip mining will not be involved in the study.

The governor also signed into law a measure aimed at cutting mine-cave damage by giving local officials powers to regulate underground mining in their areas. This bill sets up standards to guide operators in mining activity and empowers local officials to regulate mines through regular inspections and the filing of maps and plans. In noting that it contained language similar to that in the Kholer-Fowler Act of 1921 which was later declared unconstitutional, Gov. Lawrence said: "It is hoped that several differences in the instant legislation and the changes brought about by time will permit this act to withstand any court

Mines, Companies

Peabody Coal Co.'s Energy Mine at Herrin, Ill., is now jointly owned by Peabody and Forsyth Carterville Coal Co. The Energy Mine will be operated by Peabody but production sold jointly.

An old mine closed since 1922, is

Current Coal Patents

Oliver S. North Patent Research and Abstracting Arlington, Va.

Process for purifying a suspension of fine magnetizable particles in a liquid, J. N. J. Leeman (assigned to Stamicarbon N.V., Heerlen, Netherlands), Sept. 5, 1961. In this installation for purifying magnetizable material, e.g. a mixture of magnetite and ferrosilicon, used in the heavy media concentration of coal, the suspension is separated into two fractions: fines containing a high percentage of magnetizable material and a fraction consisting of the comparatively coarse material most of which is non-magnetizable. The fractions are fed into a single magnetic separator at different points, whereby the magnetizable particles are quickly attracted to the magnet without entraining any appreciable amounts of the nonmagnetics. The magnetizable particles are then rapidly discharged from the separator. No. 2,998,882.

Hydraulic crops or struts, M. J. Marlow (assigned to Dowty Mining Equipment Ltd., Tewkesbury, England), Sept. 19, 1961. Design for a rugged relief valve for telescopic hydraulic mine props. This valve can be adjusted to open at a predetermined compression load on the prop. No. 3,000,358.

Mining and loading machine having angularly related rotary disintegrators, N. W. Densmore (assigned to Joy Mfg. Co., Pittsburgh, Pa.) Sept. 19, 1961. This mining machine for working in coal mines having low headroom is provided with an improved cutting and dislodging mechanism embodying rotary digging heads or drums angularly mounted over a swinging boom and being independently adjustable to different operating heights. The mechanism can be operated in opposite directions across the working face and will effectively clean up the floor at the ribs. No. 3,000,620.

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Salem's powerful, new Dual brings low seam coal into the profit class by increasing practical boring depth to 200 feet (100% increase over previous equipment), handling augers from 18" to 30" diameter with only minor machine adjustments, and cutting straight and true in seams only inches thicker than the augers. Coal feeds back along both augers, maintaining the consistency of the size cut. Coal is cleaner and recovery is 50% higher. Your profit is higher. The Dual, like all Salem coal augers, is selfmoving. It stores 300 feet of augers in racks on the machine. The operator's view of the highwall is unobstructed.

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being reopened near Barton, W. Va., by the Lorain Coal & Dock Co. It is the Taggart Mine, located in a valley known as Hell's Kitchen. When development work has been completed in about a year, the mine will employ between 40 and 50 persons.

A contract to sink three coal mine shafts in the Buchanan County, Va., property of the newly-formed Beatrice Pocahontas Co. has been awarded to a Pennsylvania firm. Raymond E. Salvati, chairman and chief executive officer, said the 1,400-ft-deep shafts are part of a program to develop the mine to a production of 1.2 million tons a year. It is expected that the drilling operations will be completed in about 15 mo.

North American Coal Corporation, Cleveland, Ohio, a leading producer of bituminous coal for almost half a century, is poised to enter a new and promising field.

With the cooperation of Strategic Materials Corp., Niagara Falls, N. Y., the company successfully developed a new process to extract aluminum sulfate from ore found overlaying coal seams. North American's \$2 million alum-producing facility now under construction at Powhatan Point, Ohio, is expected to be in fullscale commercial operation by the year end. Bordon Chemical Co. has

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been named exclusive sales agent for the aluminum sulfate products to be produced under the trade name "Miral."

The new process will make a plentiful new domestic source of alumina available to users throughout the country since 85% of bauxite, heretofore the lone source of commercial alumina in the U. S., comes from foreign deposits.

Utilization



Canada's largest steam electric plant, the new 300,000-kw unit at Ontario Hvdro's Lakeview Generating Station, will be fed U. S. coal most of which will come from Pennsylvania and some from West Virginia. Large, self-unloading lake boats will bring the coal to the new cellular dock jutting 1,600 ft out into Lake Ontario. From there it will travel over the two 41/2-ft-wide conveyors (at right) at the rate of 4,000 tph from dock to the stockpile. Located about 10 mi southwest of Toronto, the new station will have an ultimate generating capacity of 1,800,000 kw. Power from the first of six units is scheduled for this year.

Competition

Three major concerns have developed a new steel which they report offers substantial cost savings and other benefits in construction of larger capacity natural gas transmission pipelines. Use of the new columbium-additive steel, labeled XC-60, in a 20-in-dia, 47-mi-long gas line in Texas, yielded estimated savings of \$1,000 per mi by comparison with established average cost patterns of X-52 grade pipe steel, the sponsors said. The X-52 steel is the highest grade now in general use for cross-country pipeline application, according to the report. Savings came from lower steel requirements, lower field-welding and material-handling costs, and reduced freight costs. Natural Gas Pipeline Co. of America, Chicago; A. O. Smith Corp., pipe fabricator at Milwaukee; and the National Steel Corp.'s Great Lakes steel division, Detroit, handled the project as a joint venture.

The Transcontinental Gas Pipe Line Corp. (Transco) recently applied to the Federal Power Commission for a \$49 million expansion program. Most of this amount would be spent for construction of 188 mi of pipeline laid parallel to the existing Transco system in Louisiana, Mississippi, Alabama, Georgia, the Carolinas, Virginia, Maryland and Pennsylvania. The new construction would make possible an increase of 93,405,000 cu ft a day in deliveries of natural gas to 32 existing resale customers. Total capacity of the system after the expansion would be 1,471,000,000 cu ft a day.

Safety

The Explosives Engineer magazine, which has accomplished so much in making industry aware of the value of safety, will terminate with the Nov.-Dec., 1961, issue. In 1925, the publishers of the magazine, Hercules Powder Co., conceived the idea of the now well-established National Safety Competition and co-sponsored the event for the past 36 yr with the Bureau of Mines. The bureau, which will heareafter conduct the competition, has been given the six bronze "Sentinel of Safety" trophies, whose custody is awarded annually to operations achieving the best safety records in six classes. Since 1925 the 210 competitors in four categories have grown to 675 entries in 1960 covering six

Winners of the 19th annual Pennsylvania State Bituminous First-Aid Contest held at Carmichaels, Pa., Sept. 9, have been announced. Bethlehem Mines Corp.'s Revloc Mine No. 32 placed first; J. H. Hillman & Sons Co.'s Emerald Mine came in second and Pittsburgh Coal Co.'s Montour No. 4 Mine ran third. Other winners include National Mines Corp.'s Renton Mine; U. S. Steel's Maple Creek Mine; Duquesne Light Co.'s Harwick Mine; Harmar Coal Co.'s Harmar Mine and Pittsburgh Coal's Hutchinson Mine. The meet was sponsored by the Pennsylvania Dept. of Mines & Minerals Industries in cooperation with the United Mine Workers, Pennsylvania bituminous coal operators and the U. S. Bureau of Mines.

Big Sandy-Elkhorn Coal Mining Institute held its 25th Annual Safety Day (Continued on p 52)

Coal Abroad (Cont'd from p 37)

tions: (1) closure of uneconomical pits and further mechanization of the remainder; (2) construction of coal carriers to cut cost of transport; (3) establishment of coal-using industry promotion organization, with special consideration of more thermal power plants at mine mouths: (4) extension of money at lower interest to coal industry for rationalization purposes; and (5) securing alternative employment for unemployed miners.

Meantime, the country's iron and steel interests recently claimed that Japan's average coke ratio was the world's lowest. As of Aug. 31, coke consumption in the production of one ton of pig iron averaged 1,316 lb. This remarkable fall of the coke ratio is mainly attributed to importation of higher grade iron ores, thorough use of pulverized ores in the form of sinter and pellets and the installation of larger furnaces, as well as higher efficiency of blast furnace operation attained by the steel makers.

WEST GERMANY - "If you can't lick'em, join'em" would seem to sum up the philosophy of more than one West Germany coal company. The government-owned coal mining company, Saarbergwerke, has announced it is considering branching out into the oil business and eventually building a refinery. The company fears that 30% of its coal production will be severely affected by the planned South German oil pipeline. Scholven-Chemie, with its 2.3 million ton refinery, is processing a great deal of Soviet crude while Gelsenberg Benzinag, with a 4.5 million ton refinery, also deals in both coal and oil. Both are subsidiaries of government-owned coal firms. In addition, a number of other coal mines have oil trading subsidiaries importing mainly heating fuel.

Bituminous Output

YEAR TO D	ATE PR	ODUCTION
Oct. 7, 1961		294,692,000
Oct. 8, 1960		321,881,000
1961 output	8.4% behin	d 1960.
WEEK ENDI	NG PR	ODUCTION
Oct. 7, 1961		8,595,000
Oct. 8, 1960		8,279,000

Anthracite Output

YEA	R 1	O D	ATE	PRO	DUCTION
Oct.	7,	1961			13,597,000
Oct.	8,	1960			14,051,000
1961	Oli	tuut	3.2%	behind	1960.

WEE	WEEK ENDING					P	RC	DUCTION		
Oct.	7,	1961								364,000
Oct.	8.	1960								392,000



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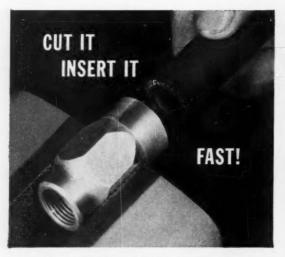
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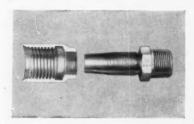
Using PARKER Fittings with PARKER Hose to make Replacement Assemblies Faster



Installing Parker "Hoze-lok®" Fittings on Parker
"No-Skive" Hose . . . NO SKIVING!



Installing ordinary fittings on ordinary rubber-covered hose . . . First, this messy skiving job.



Design of the "Hoze-lok" socket (left) makes the difference. The deep-tapped threads accept the **controlled thickness** rubber cover of Parker "No-Skive" Hose as they plow their way down to the wire braid of the hose. The rubber is displaced, not removed.



Just screw the hose in counter-clockwise, by hand. The rubber cover fills completely the space between each thread. It both protects and cushions the wire braid, eliminating a major cause of hose failure. A little Parker "Threadlube" is needed here.



The nipple, which is also the hose end fitting, screws in last, clockwise, in the usual way. You are now ready to make up the other end of your Parker No-Skive Hose Assembly. This method is not only faster; it gives you a better assembly. See next page.

You can install a Parker "Hoze-lok" Fitting on small-diameter Parker "No-Skive" Hose in 60 seconds. On 3/4" Parker hose, it takes 2 minutes or less. On very large sizes, allow 5 minutes per fitting. Hose replacement time is reduced to minutes the Parker No-Skive Way!

.. the Parker No-Skive Way

Why Parker No-Skive Hose Assemblies Last Longer



BETTER PROTECTION FOR THE HOSE AT ITS POINT OF GREATEST STRESS

Most hose failures result from flexing. Ordinary hose, skived to the bare wire at the critical point where the first thread of the hose fitting bears directly on the wire braid, fails right there. As our picture shows, the leading thread of Parker "Hoze-lok" Fittings cannot reach the wire. The cushioning effect of the compressed rubber between the threads reduces the stress concentration at this point. Gripping by direct contact between the deep-tapped "Hoze-lok" threads and the wire braid occurs well within the fitting, where no flexing occurs.

Actual tests prove the effectiveness of this better design feature. Parker "Hoze-lok" assemblies on Parker "No-Skive" Hose rarely fail at the fitting, even when stressed to the burst point.

HOW PARKER DEVELOPED A BETTER HOSE TO MAKE THESE SAVINGS POSSIBLE

Parker "Hoze-lok" Fittings can be used with any hose, but you still have to skive ordinary rubber-covered hose, even with "Hoze-lok" fittings. Parker "No-Skive" Hose, however, is made to rigid specifications that limit and *control* the thickness of the cover to the exact amount of rubber that the corresponding size of "Hoze-lok" fitting will accept, when attached without skiving.

In all other characteristics, from the inner liner to the OD of the outermost wire braid, Parker "No-Skive" Hose conforms to S.A.E. specifications. In addition, because only a better grade of rubber compound can be extruded to Parker's exacting controlled thickness specification, the increased resistance to abrasion of the Parker "No-Skive" rubber cover results in a better hose.

arker FITTINGS AND HOSE 17325 Euclid Avenue . Cleveland 12, Ohio CORPORATION MATIC AND HYDRAULIC SYSTEM COMPONENTS Gentlemen: We would like to see the Parker No-Skive Way to make up replacement hose assemblies demonstrated, without any obligation on our part, of course. ARRANGE NOW Please ask your salesman or nearest "Hoze-lok" distributor to get FOR A in touch with me: PARKER NO-SKIVE Name. **DEMONSTRATION** Title, Department or Division_ IN Company_ YOUR OWN Address PLANT OR OFFICE City___ We use hose for_ 3079-PH

Mine-POWER

by Steve Bunish

whose many years of practical experience underground followed by developmental work at Anaconda have made him a recognized authority on mining cables.



Steve Bunish answers your questions on mine cable application and maintenance.

#3: how to minimize bulk and current leakage in A. C. cable splices

Dear Steve.

We have converted one section of our mine to A.C. power. It's taking us a little time to get used to the more complex A.C. shuttle car cables, especially making splices. The A.C. splices are bulky, and we have run into some difficulty with leakage, which trips the circuit in wet areas. Any suggestions to remedy this problem?

L. D. W., Kentucky

Dear L. D. W.,

The best possible cable maintenance is necessary if you want to take full advantage of the efficiency and safety of A.C. systems. Whenever you splice a cable, you are, in effect, rebuilding the cable by hand. The following suggestions will help decrease the outside dimensions of splices and reduce the leakage problem.

- 1. Stagger all the joints in a splice. Connectors build up the outside diameter of the conductor considerably. Spreading the joints over a longer distance along the cable not only reduces the size of the splice, but also helps prevent the conductors from chafing the insulating tapes, which can occur when connectors are directly opposite one another. This should help the leakage problem, too. A good rule of thumb is to space out the joints in the conductors so that each joint is always opposite the original insulation of the adjacent conductors.
- 2. Scarf or pencil down the insulation at the joint before applying the insulating tape. This helps provide a clean surface for bonding the insulating tape, and a gradual slope for building up the insulation.

It's a good idea to have a spare cable on hand for a change-out on an off shift, so that all repairs can be made properly and permanently.

One good way to lick mine cable problems before they start is to buy cable specifically designed for the job. Anaconda makes a complete line of job-tailored cables for every mining operation.

Steve Bunish will be glad to answer your minepower problem. Simply write it up and send it to "Minepower," c/o Steve Bunish, Anaconda Wire and Cable Company, 25 Broadway, New York 4, N. Y.



Program Sept. 23 at Pikeville's City Park, Ky. Top mine-rescue honors were captured by Inland Steel Co.'s Wheelwright and Price mines while Bethlehem Mines Corp.'s Jenkins Mine No. 21 finished second and Bethlehem's Mine No. 22 ran third. Inland Steel Co. also came out ahead in the first-aid competition with its Price Preparation Plant placing first and Price Mine No. 1, second. Third place went to Turner Elkhorn Mining Co.'s Drift Mine. This program was sponsored by the institute through the cooperation of the Big Sandy-Elkhorn Coal Operators Association, Mayo State Vocational School, Ky. Department of Mines & Minerals, U. S. Bureau of Mines and the United Mine Workers of

Preparation Facilities

Eastern Gas & Fuel Associates, Keystone, W. Va.—Contract closed with Kanawha Mfg. Co. for blending bins, dust collection and railway car shakeout to handle 6x0 coal at 600 tph.

Russell Fork Coal Co., Mikegrady, Ky.

-Contract closed with Kanawha Mfg.
Co. for Wemco centrifuge to dry 1¼ x ¼ coal at 100 toh.

North American Coal Corp., Mammoth, W. Va.—Contract closed with Kanawha Mfg. Co. for railway car shakeout.

Jewell Ridge Coal Corp., Jewell Valley, Va.—Contract closed with Deister Concentrator Co., Inc. for two Concenco "77" coal washing tables to handle 4x0.

Eastern Gas & Fuel Associates, Kopperston Mine, Kopperston, W. Va.—Contract closed with Deister Concentrator Co. for six Concenco "77" coal washing tables, six Concenco two-way splitters and one Concenco Model CCF feed distributor to handle %6x48 coal.

Thompson Creek Coal Co., Glenwood Springs, Colo.—Contract closed with Fuel Process Co. for heavy-media coal-cleaning plant to handle 4x¼ coal at 90 tph.

Eastern Gas & Fuel Associates, Stotesbury No. 10 mine, Helen, W. Va.—Purchase authority issued to The Daniels Co. for a DMS dense-media precision coal washer.

Republic Steel Co., Banning No. 4 Plant, West Newton, Pa.—Contract closed with Link-Belt Co. for complete new preparation plant to handle 4x0 coal at 500 tph to preparation plant and 600 tph to storage plant. Plant includes raw-coal storage and blending, Teska H. M. separator for coarse coal, concentrating table for fine coal, flotation cells for very fine coal, centrifugal dryers and vacuum filters for mechanical dewatering and Fluid-Flo heat dryers for fine coal.



Power Company Adds Coal-Based Capacity

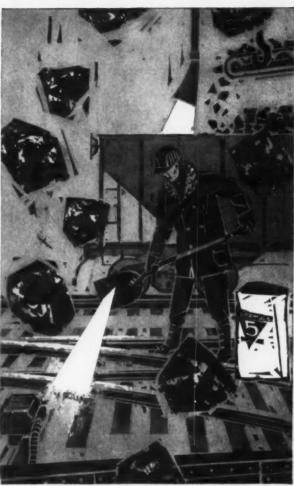
NEW MERCER PLANT of Public Service Electric & Gas Co., on the Delaware River south of Trenton, N. J., adds 640,000 kw to bring the company's total generating capacity up to 3,800,000 kw. A feature of the new installation is a coal-handling system entirely operated by one man, from river barges to boiler-feed hoppers. The operator in the unloading tower is served by a pair of closed-circuit television receivers which monitor his operation of the rotating stacker in the storage yard. The unloading bucket of 12-ton capacity is operated on a 33.2-sec cycle to provide a free-digging rate of 1,300 tph. Although coal is the primary fuel, a natural-gas system provides for boiler firing on an interruptible basis and for burner ignition on a firm basis.

A total of 4,800 tons of coal per day is required to keep the two boilers up to full capacity. The plant is expected to consume 1,425,000 tons of coal annually. The active storage pile, feeding to three variable-rate reclaiming feeders, contains 13,000 tons of coal.

Coal Scholarship Award Presented

JAMES LARRY COR-SARO is the fortunate recipient of the Scholarship Award in Coal Mining Engineering awarded by Semet-Solvay Div., Allied Chemical Corp. A graduate of DuPont High School, Rand, W. Va., Mr. Corsaro will attend West Virginia Universitaty. Representing the 10th such award gived by the Div. of Mining Engineering, the scholarship carries an annual stippend of \$600 and is subject to renewal for a total of 4 yr on the basis of satisfactory school record for the preceding year and continued attendance by the recipient.





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"Formula 5," with a new, easily distinguishable blue color, is specially made to meet the requirements of coal producers. A free-flowing product, it is composed of chemically treated sodium chloride (30-70 mesh) and a special new improved combination of anti-corrosive compounds.

Morton "Formula 5" is the safest, most effective freezeproofing compound you can buy. Even at sub-zero weather it keeps coal free-running, and serves as an ideal de-icer wherever freezing presents a problem.



Write for free booklet, "The Key to Low Cost Effective Freezeproofing." If you would also like a Morton representative to assist you with freezeproofing and equipment maintenance problems without cost or obligation, write:

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Devoted to the Operating, Technical and Business Problems of The Coal-Mining Industry



NOVEMBER, 1961

IVAN A. GIVEN, EDITOR

Mine Cost Tomorrow

With this issue, Coal Age begins its 51st year of service to the coal-producing industry and the men who make it what it is. What happened in coal in the U. S. in the first half century of Coal Age's existence was summarized in the Golden Anniversary Issue last month, along with some thoughts as to the future.

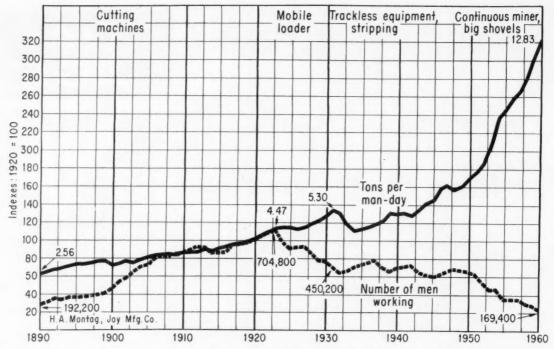
That future, the editors feel, includes the likelihood of a bituminous production level of 625 to 650 million tons in 1970—a very sizeable jump from the probable 400 million or so of 1960. This latter, incidentally, is some 40 million tons under the total in 1936, when *Coal Age* celebrated its Silver Anniversary. At that time, as in 1961, coal was pulling out of a depression that had dropped the tonnage to 310 million in 1932, much lower than the low in the present recession.

Even though output levels of 625 to 650 million in 1970 may be argued, a lot of new mining capacity is going to be required. What will the new mines be like and what will they cost to build? As pointed out last month, these mines probably will be both big and be simple. Even underground probably not over one or two face units operating 650 to 660 shifts a year will provide the entire output.

These units will cost—one reason being that they will be engineered and built to run three shifts a day months on end. But if two units costing \$1,600,000 provide 2 million tons a year the investment becomes \$0.80 per ton of actual annual capacity. Investment in service facilities—haulage, hoisting, ventilation, wash-and-change houses, parking lots, supply houses, offices and so on—will vary depending upon conditions, but should not be over \$2 per ton of annual output capacity. Preparation, especially if comprehensive fine-coal and water-handling facilities are involved, would be a substantial item—perhaps as much as \$3 per ton of annual capacity on the basis of 3-shift operation matching face-unit operation.

One conclusion from figuring such as this is that new mine capacity—if equipment can be operated continuously at high rates—may not be so expensive after all. It should be possible to come up with really topnotch properties at not over \$6 per ton of annual capacity and possibly as low as \$4 or less—again providing continuity at high rates per hour can be achieved.

Operation on a basis such as the preceding is not quite here, but it is close. If this concept is not now being included in planning for the future, it should be. Even though it may not be possible to move to it at once, it will be easier to put it into practice if plans are laid now—and it could mean a lower investment cost per ton as well as a substantial additional cut in cost in mining tomorrow.



HOW PRODUCTIVITY has risen at bituminous coal mines from 1890 to 1960, with key equipment developments affecting this rise.

What's Ahead in Productivity... And the Capital Problem

W. L. Wearly, president, Joy Mfg. Co., Pittsburgh, Pa.

Research and development of new equipment, and the application of new systems concepts, can bring further major increases in productivity, with corresponding reductions in mine cost. But research and development money must come from the capital expenditures of the industry, which have declined even more sharply than production. It is a problem that the industry must face up to if maximum progress is to be achieved.

"INCREASED PRODUCTIVITY through technology" involves not only research and development, but also the important problems of financing the research and development that assuredly can—and will—lead to increased productivity if the necessary funds can be generated.

It is generally recognized that more ideas are available for future research into improved technology in all fields of endeavor than there is money available to finance them. This even applies to the government's space program. Thus we can conclude that money for research expenditures, as well as money for capital investment, will be most readily available in those areas where there is the greatest probability of payoff.

As a starting point in discussing the situation, consider the data in Table I. Col. 1 shows bituminous production figures, and particularly the drop from 516 million tons in 1950 to 415 million in 1960—a bleak picture indeed. But the less-oftenthought-of record of capital expenditures (Col. 2) shows that the capital spending of the industry has dropped at an even faster rate than output—from a high in 1952 of \$382 million to a little over \$100 million in 1960.

To make matters worse the annual production of nonunion mines has grown to the astounding figure of 80,000,000 tons. (Let me hasten to add that being nonunion is only symptomatic of the problem-not the cause.) This estimated production comes from small, relatively unorganized mines that do not use plant and equipment of the kind generally considered as representative of modern mechanization. Therefore, it might be inferred that this 80,000,000 tons of production does not generally contribute to the economic well-being of the coal industry nor to the financing of its long-range research effort. Thus, instead of the capital machinery producers catering to a 400,000,000ton bituminous coal market, they are actually serving a market only

Abstract of a paper entitled "Increased Productivity Through Technology," presented at the conference on "Coal's New Horizons," sponsored by the Southern Research Institute, and held at Birmingham, Ala., Oct. 3-4. Synopses of other papers appear in a separate meeting report elsewhere in this issue. Complete proceedings of the conference may be purchased from the Southern Research Institute, 2000 Ninth Ave., Birmingham 5, Ala.

Table I—Output, Capital Expenditures and Productivity in the Bituminous Coal Industry

	Production, Million Tons (USBM)	Capital Expenditures, Millions (McGraw-Hill)	Tons Per Man-day (USBM)
1950	516.3	N. A.	6.77
1951	533.7	\$362	7.04
1952	466.8	382	7.47
1953	457.3	312	8.17
1954	391.7	184	9.47
1955	464.6	147	9.84
1956	500.9	257	10.28
1957	492.1	213	10.59
1958	410.4	155	11.33
1959	412.0	150	12.22
1960	415.5	108	12.83
1961	****	Est. 120	
1962		150	
1963		97	
1964		111	
1965	*448		
1970 * National Coal As	*520 sociation estimates.		

slightly in excess of 300,000,000 annual tons.

The manufacturers' research and development expenditures are financed out of the proceeds of the industry's capital-expenditures programs. As these expenditures become more fragmented it becomes apparent that financing the future technological advances of the coal industry poses a problem—a problem that the coal industry itself must face up to. And, based upon McGraw-Hill's estimate of capital spending through 1964, no improvement is indicated.

But let us review the productivity records that have already been achieved since 1950. Productivity in tons-per-man day has almost doubled (6.77 tons in 1950 to 12.83 in 1960). Virtually a technological revolution has taken place while the industry's production was on the skids. We might hopefully reason that any industry that has shown such remarkable increases in productivity surely should be able to attract new money to make possible further cost-reducing capital programs. Should this happen, it follows that increased research might be financed.

The long-term productivity pic-

ture in bituminous coal is shown in the accompanying chart. Historical highlights in mechanization are indicated. These mark significant up trends in productivity.

The tons-per-man-day curve shows the sharp rise in productivity during the decade 1950 to 1960. This was made possible by the large capital-expenditure program carried out by the coal industry immediately after World War II and on through the early 1950s. The bottom curve shows the rise of total employment in the coal industry to the peak of 704,800 men in 1923, and after that a long decline in total employment to the current low point of 169,400 in 1960.

There have been few periods in the past 30 yr when the coal industry has generated sufficient earnings and cash flow to cover any kind of substantial capital investment program. The 10-yr period of prosperity after World War II was an exception. But today, again, the coal industry, as a whole, will be hard pressed to generate sufficient cash flow to finance any substantial capital program. This is particularly true as a result of the poor price structure that exists in competitive coal markets today. In my opinion, this poor price structure is, in itself, a con-

Table II—Cost Trends and Future Possibilities in Bituminous Mining

	Direct Costs per Ton*							
	Production Labor	Service Labor	Sup- plies	Power	Total			
1950	\$1.30	\$0.99	\$0.66	\$0.12	\$3.07			
	¥	+	¥	*	*			
1960	.89	.89	1.03	.13	2.94			
	*	+	+	+	+			
19701)	.61 .40	.79 .70	1.66 1.20	.14	3.20 2.44			
3)	.08	.40	1.00	.15	1.63			

1) Straight line projection of previous 10-yr trend.

Results expected based upon technological improvement in present equipment and system concepts.

Results expected based upon automatic pushbutton mining system involving new concepts.

* Do not include depreciation, supervision, administration and welfare overhead costs.

Source, 1950-60 data, E. H. Greenwald, Eavenson & Auchmuty & Greenwald.

tributing cause toward curtailing the availability of funds that would enable coal producers to offer the consumer even lower cost fuel for the future.

Those fuels with which coal competes today are basically produced on a continuous-process basis rather than on a batch or cyclical basis. In earlier times, many of today's great industries operated on a batch or intermittent basis. These included such industries as chemicals, oil refineries, metal processing, etc., all of which today are set up for continuous processing—generally on an around-the-clock basis seven days per week.

Can the coal industry really hope to compete with competitive fuels produced by a continuous process on such a basis? Note that this is the basis for the production and transportation of oil and gas and, for that matter, hydroelectric power. Let us examine coal's situation:

Instead of an oil refinery that operates as a continuous process 24 hr per day, or 8,760 hr per year, a "coal plant," if we may use the term, is seldom utilized more than 5 days per week on a one- or two-shift basis in underground mining. Let us say that the coal plant is now utilized 3,000 hr per year in contrast to 8,760 hr per year for the refinery. Thus, it is obvious that investment in the "coal plant" used for underground mining has poorer utilization than that in an oil re-

finery, or for that matter, in a coalstripping operation. Conversely, we might reason that far less money will be made available from the capital market for underground "coal plant and equipment" than for refinery plant and equipment. The capital market is looking for returnon-investment.

With this background, let us look more closely at a breakdown of the costs in a typical coal-mining area (Table II). The figures shown are an actual composite of several mines in an area where seam thickness ranges from 4 to 7 ft, all with mechanical loading, and all achieving what is considered excellent mining efficiency. The production labor includes so-called face men. The service labor includes haulage and handling to the railroad car and the handling of all supplies and shop maintenance.

- 1. It is noteworthy that no significant inventions occurred in the period 1950 to 1960.
- 2. But in the 3 yr immediately preceding 1950, the first actual working concepts of continuous mining machines were commercially introduced.
- 3. In strip mining, the decade of the 50s marked the advent of the giant shovels.

Possibly because of the stimulus that resulted from the introduction of the continuous-mining concept, as well as large stripping equipment, conventional mining equipment was radically improved to provide more than triple the performance and productivity that had been achieved at the end of World War II. Important design progress can be measured by a comparison of relative horsepower and machine weight. Prices are also shown.

	1945	1960
LoaderWeight, lb	18,000	29,000
Horsepower	39	87
Price	12,400	\$36,765
Cutter Weight, lb		34,100
Horsepower		152
Price \$		\$61,265
Shuttle		
Car Weight, lb	16,000	30,000
Horsepower	221	6 80
Price	8,500	\$39,250
Drill Weight, lb	6,300	19,500
Horsepower	81	
Price	6.200	\$42,930

Each of these machine functions has been developed to require only one operator today. The operating crew may be reduced from as high as 10 or 12, including multiple drilling and cutting operations, to 5 or 6 with the expectancy of more than doubling production. In 1945, production per shift of 200 to 300 tons per loading unit was considered normal. Today, with a smaller crew, loading-unit productions of 600 to 1,000 tons per shift are being achieved.

It is my opinion that the design engineer did not originally set out to reach the goal that was actually reached in 1960. Rather, I believe it was his intention to develop machinery that would have greater availability by providing more reliability and lower maintenance cost. The horsepower of motors was increased to prevent operational heating and to provide longer life; the general ruggedness of clutches, gearing, and other components was improved; better alloys were used throughout; finger-tip controls were employed to provide operating ease and less operator fatigue.

But the thought of achieving lower maintenance cost probably occurred without properly reckoning with the mining engineer and the industrial engineer, both of whom went to work and developed more efficient mining systems and better methods for utilizing the new equipment. As a result, the remarkable increase in tons per man shown

here was achieved, but service-labor costs declined only slightly, and supply costs almost doubled. The greater reliability designed into machines was in effect used up by the production engineer to set higher production records and, as a result, maintenance costs got worse instead of better.

To this time continuous mining has been a cost-reduction leader in some favorable areas and, broadly speaking, has been a catalyst in general improvement of productivity even in areas where it has not been used. Continuous mining has set the pace for productivity without actually having gained acceptance for all conditions. To reach its ultimate possibilities, the continuous-mining system and its respective machinery components requires further work by the design engineer, by the mining engineer, and by the systems planner-but more about this later.

The projection from 1960 to 1970 shown as Note 1 in Table II is a straight-line projection of the previous 10-yr trend. Although this shows a continuing reduction in labor cost, the rising increment represented by supply cost more than offsets the labor saving. As a result, the total direct costs show an increase from \$2.94 to \$3.20 per ton—not bad for most industries, but for the beleaguered coal industry something better must be planned.

In my judgment, the total cost of \$2.44 shown under Note 2 must be achieved. To do this the design engineer will attack the higest-cost area-namely supply costs-or conversely he will design for greater equipment reliability.

And the catalyst for all of this may again be found in the continuous-mining system. Continuous haulage is the key to a major breakthrough in continuous mining. A few continuous-mining operations today have what might be termed semi-continuous haulage systems. I have seen a crew of 5 total face men produce more than 1,500 tons in a shift with one continuous mining machine and an extensible belt conveyor. This is an excellent target to plan for on a regular basis.

Ingenuity, perseverance and sweat will bring these systems to a successful conclusion if we have the money available to finance the program. A system concept in any industry is massive and expensive. The coal industry has generally thought only of component machinery engineering rather than complete system design. This latter is the answer, in my opinion.

The system concept necessarily will be tied to continuous-mining-type extraction. This will provide one great cost saving that can never be achieved even with further improvements in conventional equipment. That is a reduction in the area of the mine far below what is required for conventional multiple-room methods.

Let us now move ahead one giant step to the automatic pushbutton mining concept to see what advantages it has to offer. Note 3 in Table II shows our estimate of a total cost of \$1.63 that can be achieved based upon initial operating tests. As an industry first, this embraces the continuous process system concept as is used in many other great industries, some of which compete with coal. It can and should be employed on the around-the-clock basis. Although the initial use of automatic mining is more readily had in highwall mining, in our opinion it can be equally well employed underground in what might be described as a modified longwall system.

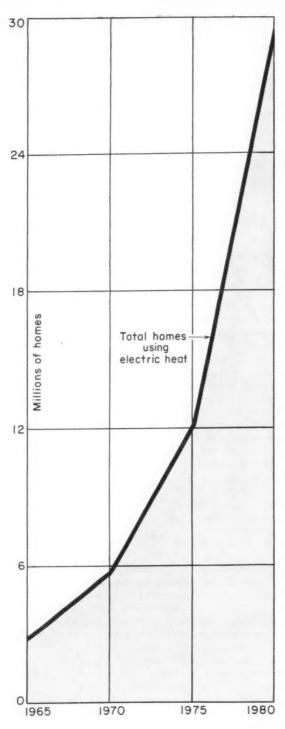
What are the recognizable advantages of automatic pushbutton mining?

- 1. This method probably approaches the ultimate in mining concentration.
- 2. It obviously approaches the ultimate in per-man productivity.
- 3. From the safety standpoint, man-hours of exposure are minimal.
- 4. It introduces to coal machinery, for the first time, what I like to call "steady-state" operation. If the machine is designed to utilize 350 hp in the mining operation, that is what is used—not temporary damaging overloads of 500 hp nor periods of inactivity when only 100 hp is employed. The machine cannot be jammed into the face by the operator nor called upon to do more than its design capability.

- 5. As a direct result of steady operation, bit life has been extraordinarily good. Bit cost is less than one-third of the figure considered normal for boring-type miners. Other machine components—motors, clutches, gears, etc.—are likewise operated within their capability, not overloaded.
- 6. From the standpoint of extraction rate, or rate of advance, automatic controls with the electronic guidance system employed make possible 3 to 5 times the rate that can be realized with visual manual control. Operators have their hands full keeping a conventional boring machine on sights and in the seam at a rate of 15 to 20 inches per minute. Yet with the automatic guidance system used I have observed "steady-state" rates of advance of 5, 6 and 7 feet per minute. The machine components were all working quietly and within their design capability.
- 7. On one of the good shifts, I observed 1,138 tons mined in about 6 hr actual operating time—this in a coal seam 46 in in thickness. One operator controlled the machine; two helpers aided when moving from hole to hole and spotting bits. The first room or hole was advanced to completion at a depth of about 540 ft. The next was advanced about 400 ft at the end of the shift.

This new automatic Pushbutton Mining concept could well be a new catalyst for another productivity breakthrough. It is typical of an idea which the coal industry—operators, labor and equipment manufacturers, working together, as in the past—must be seeking: a technological development that attracts new capital.

Research costs are increasing due to the greater complexity of such system concepts. Coal's financial resources are limited. However, if the coal industry will direct all of its resources toward long-term positive cost reduction, rather than diluting its facilities for short-term advantage, it can and will attract capital for profitable economic growth through intelligent research—the promised payoff.



the electric-utility industry can build on present momentum, the number of homes with electric heat should grow as shown in the curve, based on the most-recent survey by Electrical World.

BUT this means that gas will suffer in a market it recently has taken over. Therefore, the gas industry is now making plans to tackle the utilities on air conditioning to keep its heating market.

The Gas Target For Today

By Charles Hochgesang Editor, Electrical World, McGraw-Hill Publishing Co., Inc.

With 1,116,000 home installations at the end of 1961, the electric-utility industry and its allies are "at the end of the beginning" in the sale of electric heating for residences, commercial operations and industries. Reporting on the results of its most recent survey, John Damon, of Electrical World, a McGraw-Hill publication, at the Fifth Electrical World Electric Heating and Heat-Pump Conference, Washington, D. C., Sept. 25-26, forecast 2,450,000 home-heating installations at the end of 1965; 5,200,000 at the end of 1969; 12,000,000 at the end of 1975; and 29,000,000 at the end of 1980. The conference was cosponsored by the Residential Electric Heating & Air Conditioning Committee and the Commercial Electric Space Heating & Air Conditioning Committee of Edison Electric Institute, and the Electric Comfort Heating Equipment Section, National Electrical Manufacturers' Association.

The new figures, Mr. Damon noted, mark an acceleration in the growth rate, which of course is good news to coal men—if electricity can hold the business. The "if" arises from the fact that natural gas now realizes that it must beat electric heating or retire from the field. An analysis of its approach and its goals, by the editor of *Electrical World*, therefore was a high spot of the conference. Because gas' intentions here and elsewhere are of direct and vital concern to coal men, the editors of *Coal Age* bring you this thought-provoking address in the columns that follow.

WHEN the second millionth electrically heated home will be built is a matter of major interest. But of even more interest are the approaches of two different industries to the period after that second million.

The two are, of course, the gas industry and the electric industry.

Let's take a look back, for a moment, at history. The gas industry began in the illuminating business by taking it over—rather easily—from oil. On losing the lights to Mr. Edison's invention, it took over the range and water heater.

When natural gas and the trunk pipelines arrived, new markets had to be developed beyond industrial uses, so the push was on for space heating. The gas industry found that it could take over in most areas rather easily from coal, and a little less easily from oil. It is now completing its conquest of oil in many, many areas.

The electrical industry got started in illumination and in traction. It took illumination rather easily from gas, and then expanded to other motive power uses — stationary and plug-in motive power — eventually losing most traction load to oil.

In the residential area it began to compete with gas for the range and water heater. In both the residential and commercial areas, it first resisted, then accepted, then promoted air conditioning as it developed as another motive power use.

For all intents and purposes, illumination, stationary motive power and most incidental appliance uses have become the exclusive province of electricity.

New Battle Ground

Space heat has become, or has been becoming, the exclusive province of gas—at least for most non-industrial uses. If there has been a real battle between gas and electricity, it has been for the range, the water heater and, latterly, the clothes dryer.

More recently electricity, faced with a growing imbalance of load because of rising air conditioning peaks, has entered the space-heating field. That is why we are meeting here today. Already we have a 2% residential space heating saturation. We talk of perhaps 10% within the decade.



Mr. Hochgesang

Meanwhile, the gas industry, itself faced with seasonal imbalance of loads because of soaring space-heating sales, has centered more of its attention on air conditioning. Note the similarity. Each industry can now see the other out of the corner of its eye—or, more accurately, back over its shoulder—threatening a heretofore exclusive domain: electricity threatening gas space heating, gas threatening electrical air conditioning.

Let's look separately at the residential and commercial markets. In the residential market, barring really major scientific breakthroughs in self-generation, electricity seems relatively safe for illumination, motive power and incidental appliance uses. For the electrical industry, heating has become the pivotal residential load. By capturing it, we can be assured of dominating the "battleground" loads—the range, the water heater, the dryer, and be protected against potential loss of the air conditioner and the refrigerator to gas.

Gas, on the other hand, is temporarily in control of space heating. For it air conditioning should be pivotal—or so it hopes. This would protect its space-heating market and would put it in a priority position for dominating the range, water heater and dryer loads—at least pending the day when gas-fueled self-generation — it hopes — comes along.

In the commercial market, electricity, we like to think, again is relatively safe for illumination, motive power and incidental load. Space heating again is pivotal to protect air conditioning. And now we come to a time when gas is casting covetous eyes at illumination and motive power as a means of protecting commercial space heating and capturing the commercial air-conditioning load.

Who Is Vulnerable?

In the growing confusion, we face the crucial question: Which industry is more vulnerable to attack from the other?

To start with, long-range—very long-range—time is with electricity and against gas. Why? Electricity can be made from gas. It also can be made from falling water, from coal, from oil and from nuclear materials. Gas will be out-survived by fuels from which electricity can also be made. Meanwhile, electricity, through its inherent flexibility and potential for innovation at the point of use, will trade on this innovation and perpetuate itself.

But this is very long range. And notice I'm referring to "electricity"—not necessarily to "the electrical industry" when I say "perpetuate" itself. There's no guarantee that our industry has the same degree of flexibility inherent in the product for which currently it is almost the exclusive marketing agent.

Looking specifically at the futures of the two industries, as we know them today, we must seek the answer in the shorter-range picture.

Shorter range, it would seem, the electrical industry is in good competitive shape. The public shows, has has shown, and we hope will continue to show, preference for electric service as "the modern way." The electrical industry is the industry of innovation. And the public believes and we hope will continue to believe this.

Moreover, the trend in the prices of gas vs. electricity continues to work in our behalf and against gas. The price of gas continues to move up with time. The price of electricity continues to hold its own even in face of inflation. So, even short range, we would think gas is the more vulnerable, and this would seem to auger well for the electrical industry.

The danger is that the gas men

have realized, quite suddenly and quite recently, that electricity, not oil, is their real competitor. And this realization has given them sudden insight into the course they must steer. They know that they must innovate-and go for air conditioning in residential and commercial markets. They know they must innovate -and go for motive power and illumination through self-generation in the commercial market. They know that they must innovate-and eventually go for all residential loads through self-generation "under the kitchen sink.

Far-fetched as all this may seem, they are at least working at it with a single mindedness of purpose. Moreover, they know that they must bolster their public image through intensive promotion—showing the public that they are innovating, that they too are an industry of innovators.

The gas men know that they must band together for sharing information among all sectors of their industry—the utilities, the manufacturers, the heating and air conditioning systems design engineers, and the marketing men. This latter category includes both marketers of appliances and equipment and marketers of the cubic foot of gas.

As an industry, they have decided that they cannot afford the luxury of divided effort—that they must attack this problem with a single-minded focus, with a single-industry approach, and under a single-industry association. This single-minded, coordinated program extends from policy-making right down to equipment innovation, and includes all aspects of marketing.

Gas Goals

To give you an idea of the degree of coordination and singleness of purpose of this gas industry, I want to read you some brief excerpts from their Gas Industry Development program—their "Gid" program.

Their first goal under "Marketing" is "To maintain and expand established markets, develop markets for new uses, and to reverse any adverse market trends." Platitudes, you say. O.K. But here are the pertinent points of their action program for reaching this goal:

"Each gas utility to establish its

leadership by direct selling of topquality residential appliances and equipment, thus encouraging those manufacturers which actively improve and develop their products; and provide substantial advertising and promotional support for their sale."

"Each gas utility to stimulate and intensify dealer sales of gas appliances by providing promotional leadership and cooperative programs."

-"Each gas utility to set up a builder program to offer builders, architects, engineers and home owners more and better cooperation than our competition, with special reference to package installations."

"All gas utilities to intensify gas air-conditioning sales activity in residential, commercial and industrial markets, and to guarantee increased market for presently produced residential air-conditioning equipment, so as to reduce unit costs of manufacturers and encourage their research and development."

In this same AGA committee document, the gas men set out some very specific marketing goals to be reached by 1965. For instance, they want to:

Increase the present level of residential gas service from 74% of U.S. homes to 79% by the end of 1965.

Increase commercial gas service from the the present level of 2.9 million customers to 3.75 million by

Sell at least 1.5 million central gas house-heating units annually.

Sell at least 50,000 central gas airconditioning units annually.

In the research field, this AGA committee recommends that the industry act immediately to "apply maximum amount of available research funds to a 'crash' program to develop fully competitive year-round air conditioning equipment."

We know that the scope of the gas research and development program ranges from the far-out little black box to the do-it-yourself generation of electricity already installed in a Little Rock (Ark.) shopping center.

The Gas Industry Development committee urges the gas industry to "develop and maintain continuing awareness and knowledge of research and development programs of other industries whose achievements may affect the prospects of the gas industry." Or we might interpret this

to mean-keep a close eye on usthe electrical industry.

The document from which I have been quoting is entitled, "Summary of Short-Range Goals and Actions." It is now in the hands of all gas utility presidents for study and adoption. It sets out the goals and the action programs for the period through 1965. It has the full backing of AGA President Lester T. Potter, who tells his audiences: "I would far rather be working toward an established objective that turned out to be wrong than be working with no plan or direction at all." There you have an example of what we are up against.

There is purpose behind it. There is desperation behind it. There is a growing amount of discipline behind it. I repeat: They are up against a superior product. They know it. Their only weapon is organization and a single-mindedness of purpose of everyone concerned. They have taken that step. It could hurt us badly over the next decade or two.

The Electrical Approach

Now let's look at our own approach—or, more accurately, approaches.

We have meetings like this one, sponsored by *Electrical World*, in cooperation with the major national associations. We have the Edison Electric Institute and its committees and the meetings they are holding. We have the National Electrical Manufacturers Association and its committees and the meetings they are holding.

We have the regional associations—and the meetings they're holding—and the various national groups who are holding regional meetings for various aspects of heating. These regional and local meetings deserve continued and increased support. They are carrying the brunt of the educational effort so necessary at this stage of electric heat marketing. This is the grass-roots approach that must not be stopped.

We have the investor utilities and the noninvestor utilities. We have the straight electric companies and the combination companies. (They've got the combination companies too, but it doesn't seem to bother them as much.) We have the manufacturers of various types of heating equipment. We have a few heating and ventilating systems designers and architects who have a deep-dyed faith in the electric way.

What we do not have is a single organization with a single-minded approach, or a single policy for pushing electric heat on all fronts and for the benefit of all.

Gentlemen, the only force that holds us together even for these brief meetings is the animal instinct to sell successfully. Our approach to promotion is improving. I refer mainly to the "Live Better Electrically" program and what it is doing for electric heating. We may be making some progress in small ways on a company-by-company or even on an association-by-association basis.

As a matter-of-fact, there are those who think our heating load is growing at a satisfactory rate. In fact some utility people think that we don't want to grow too much faster than now because we might get too much of this heating stuff on the line before we really understand it

But, gentlemen, I submit that our innovation in the electric climate-control systems-design area—that is, in the design of systems to take full advantage of the equipment we've got, especially for commercial and industrial structures—is rapidly losing ground to our competition. The gas men are learning more about what to do and how to integrate the products they have into effective. efficient systems and how to sell these systems to consumers. And even in the residential field we could do far better.

They are learning faster than we are because they are working together more closely than we are.

The Job Ahead

I submit that we are in danger of having our product innovation lose ground to gas. For one thing, there's no strong voice from systems engineers telling the product designers what's needed next — and even strong voice from utility sales people watching this crucial area. The interplay between product and systems design is a factor that has always been paramount in pushing back frontiers. We are not paying attention to it here, as an industry.

I submit that our marketing meth-

ods never were as good as theirs. We have never put the liberal percentage of revenues into marketing that they have. Our promotion, although it is improving, most certainly runs a poor second to theirs—if only because of the amount of money they are willing to put on the line.

I submit that the electrical industry is letting itself slip into a most vulnerable position.

Regardless of the superiority, long-term, of our product; regardless of our conviction that this form of energy will prevail over any other form for end use; I submit that a well-organized, well-disciplined, well-co-ordinated program by the gas industry can well catch us by the heels over a short-range period in a manner that could shake the existence of our various corporate systems to their very foundations.

I submit that our answer is a relatively simple one if we would only take it. We need—we must have—as the gas men have recognized and increasingly have, a single-industry, disciplined, coordinated, focused attack on innovating, marketing and promoting in the heating area.

We have a specialized precedent of the single-industry approach in the "Live Better Electrically" program. Some of us were amazed that we have been able to do it at all in spite of ourselves. We were amazed at its evident success. But, I submit again, it has not gone far enough, and is only one element in the complete program needed.

We need the shoulder-to-shoulder attack of all the sectors of our various industries represented here to-day. This attack must encompass the elements of product and systems innovation and all types of marketing.

We need the shoulder-to-shoulder attack of all sectors, coordinated and pulling toward achieving this pivotal load, electric heating. We need full informational interchange on a national, regional and local basis. We need the manufacturers and utilities working closely together to find out early what each other needs, and then innovating, experimenting, testing and sharing together. We need a stronger promotional approach by all concerned to match or overmatch theirs before

the public image smiles on the other side of its face.

Now this sounds like an inspirational message. But this is meant to be more than a merely inspirational message. I am serious—deadly serious.

Needed: Single-Industry Approach

I recommend here and now that the number of organizations holding national heating conferences be reduced as a first step toward coordinating and solidifying our efforts in gaining this electric heating market. I am offering to take *Electrical World* out of this national heating conference business right now. I am offering to have this be the last one of *Electrical World's* heating conferences so that we may wholeheartedly join with a single-minded industry group to reach our goals. I was never more serious.

I am recommending here and now the formation of a single national group to set policy to coordinate, to sparkplug, to discipline if you will, the innovation, the national aspects of marketing and the overall national promotion of electric heating.

I conceive of a national organization representing and drawing from utilities, manufacturers, and heating and ventilating consulting engineers and other allies who are friendly to electricity.

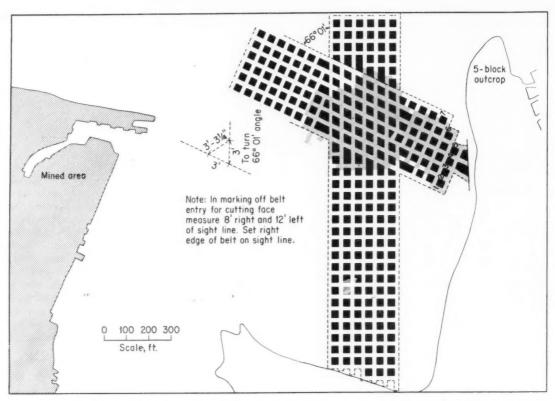
I am charging each of you with the responsibility for taking this idea to your managements to see whether such an organization cannot be constructed with EEI, NEMA, and the appropriate engineering and marketing groups, as members.

Even at the risk of giving comfort to the competition, *Electrical World* will at the appropriate time mount an editorial campaign to support this idea so much are we convinced of its necessity as a measure to achieve the pivotal load of electric heat.

We must have this single-industry approach.

When will we get the second millionth electrically-heated house? That's easy: in 1964-1965 at the latest.

But that is not what concerns us here. It is what happens after that!



MINE PROJECTIONS are laid out to provide flexibility when faults or other unusual conditions arise.

How North American Coal combines deep- and punch-mining methods for . . .

High Production with

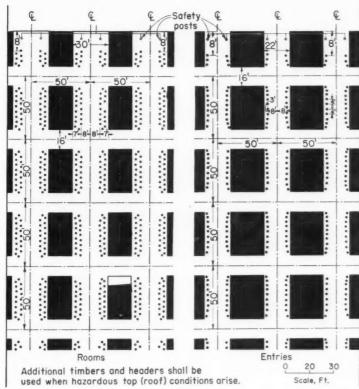


LOADER-SHUTTLE CAR COMBINATION averages 0.43 min per ton loading rate to obtain 16.6 tpm over the payroll, a figure that is expected to increase.

COMBINED DEEP- AND PUNCH-MINING METHODS using conventional mining equipment net 16.6 tpm over the payroll at North American Coal Corp.'s Laurel Fork mines, Mammoth, W. Va. This tpm figure is expected to increase as soon as the modernization program now going on in the preparation plant is complete. This involves installation of a Daniels double dense-medium washer which, among other things, will increase coal recovery in the preparation cycle.

Mobile-type operation is employed because of hilltop seam location and also to overcome seam faulting which occurs as a result of large sandstone rolls or partial sandstone cutouts.

The system of mining is not in its strictest sense punch mining, but it has all the characteristics on a somewhat larger scale than normal. Sur-



TIMBERING STANDARDS for entries and rooms contribute to maximum safety.

Conventional Equipment

face buildings, such as, lamphouse, office, substations, etc., are mobile. Each operation, normally, penetrates the seam for approximately 4,000 ft and then mines to the right and left on retreat.

The company has established policies which voice management's philosophy on regulations relating to production, labor and mine cost. Strict adherence to these rules has been responsible, at least in part, for the company's success. The rules follow:

- Keep operations small, compact and mobile.
- Continually improve production through advanced mechanical and technical know-how.
- 3. Make improvements underground and in the preparation plant where money spent will show up in terms of increased production and better-quality coal.

- 4. Limit mine development to approximately 4,000 ft depth.
- 5. Include flexibility in the mining plan to compensate for faults and other unusual mining conditions.
- Improve coal quality to meet market demands.
- 7. Maintain good customer relations.
- 8. Provide adequate maintenance facilities for mines and equipment.
- 9. Establish and maintain good labor relations.
- Provide educational improvement programs for employees.

Mining Property

North American's property is approximately 25 mi east of Charleston, W. Va., on Kellys Creek. The preparation plant is located at Cedar Grove. Laurel Fork Mines Nos. 4 and 5 are about 6 mi from the

preparation plant. Mines and preparation plant are served by the Kellys Creek R. R., a company subsidiary, which interchanges with the N.Y.C. R. R. The company railroad also serves the river loading facilities on the Kanawha River, as well as mines of the Union Carbide Metal Co. The K.C. R. R. Hauled 778,000 tons of coal in 1960. Company production was 518,000 tons.

Approximately 70% of the production goes out by river transportation and the remainder by rail. The monthly production level is approximately 60,000 tons.

Mining is in the Five-Block seam, which averages 5½ ft in thickness. The top is primarily sandstone and the bottom hard fireclay. The seam is relatively level and is approximately 150 ft above drainage. Reserves total 42,000,000 tons.

Entry Development

Seam location and conditions dictate mine projections. Projections usually vary for each new setup. Normally the seven-heading system is used. However, it is not uncommon to go to nine headings. Headings are 20 ft wide on 50-ft centers.

The projection for Mine No. 5 (see illustration) employs the standard seven headings. The main entry will be driven to the maximum depth with right and left entries turned off the main on an angle of 60 deg. This projection is flexible and provides alternate plans in case faults are encountered.

Spare Equipment

Spare units at each mine are essential in the three-shift production schedule—not only for maintenance reasons but also to minimize production downtime. This equipment is kept as close to the face as possible to speed exchange in case of breakdowns and to permit periodic preventive maintenance on the sections.

Mine No. 4 is a double-equipped setup with each team of equipment on production. Mine No. 5 is a single-equipped section. Production equipment lists at No. 4 and 5, excluding spare units, are as follows:

Double Unit:

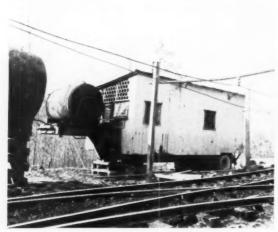
Two 13 BU Joy loaders.



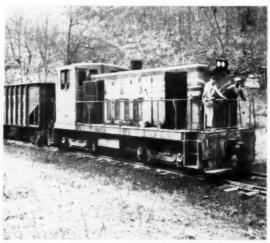


VAN-TYPE TRUCKS serve as lamphouse and office, eliminating construction of temporary buildings as openings advance.

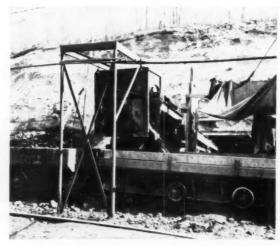
Power is brought in from overhead lines.



MOBILE DIESEL SUBSTATION provides fast power setup for punch-mine operations before power lines are completed and underground units needed.



COMPANY-OWNED RAILROAD (connecting to NYC R. R.) hauls coal from mine to plant and river-loading facilities. It interchanges with the NYC R. R.



 $\ensuremath{\mathsf{TRACK}}$ HAULAGE from No. 4 mine to railroad loading ramp. Coal is then transported by rail to cleaning plant.



OUTSIDE LOADING STATION at No. 5 mine uses truck haulage from mine to crushing and screening plant.

12 RB Joy cutter.
10 RU Joy cutter.
Five 6SC Joy shuttle cars.
TDF-25 Long-Airdox mobile hydraulic coal drill.
30-in Goodman rope belt conveyor.

Single Unit:

965 Goodman loader.12 RB Joy cutter.Two 870 Goodman shuttle cars.Two Baker jeeps (supplies and mantrip).

The haulage system at No. 4 mine consists of shuttle cars which discharge onto a section belt conveyor. This conveyor in turn discharges into 31/4-ton ACF dropbottom mine cars. Average mine-car haulage distance is 1¼ mi. Track is 42-in gage and consists of 60-lb steel. Cars are unloaded in a 100-ton storage bin and then fed onto a 30-in belt which discharges to a crusher. Coal is crushed to 8 in and then conveyed to a screening plant and loaded into railroad cars. Carbon is shipped directly to market via river or rail transportation. The 8x%-in product goes to the main preparation plant for cleaning and sizing.

The haulage system at No. 5 mine consists of shuttle cars and section and mainline belt conveyors. Coal is discharged from the main belt into a truck-storage bin and then is hauled to a railroad loading ramp. This coal is transported to the main preparation plant for cleaning and sizing.

The K. C. R. R. has 14 mi of track, including spurs, and 50 70-ton hoppers. Distances from mines to cleaning plant and river-loading facilities are 7¼ and 8 mi, respectively. Two General Electric 70-ton diesel-electric and one GM 125 ton diesel-electric locomotives are used. One unit can handle 35 loaded cars.

Skid-mounted M-G sets and vantype diesel-electric substations supply power for the mines. Diesel units are moved in on the initial setup.

Full-Production Crews

Single- and double-unit production crews are made up of the following:

Single Unit: Loader operator. Cutter operator and helper. Two shuttle-car operators. Timberman.

North American Management Team

Robert N. Morris, division general manager.

Ken H. Hudnall, superintendent.
J. A. Gothot, chief engineer.
Raymond Rogers, master mechanic.
G. V. Coon, preparation foreman.
George Kincaid, general mine foreman.

W. R. Stevens, safety director.

Shotfirer. Mechanic. Foreman.

Double Unit:

Two loader operators.
Two cutter operators.
Two cutter helpers.
Coal-drill operator.
Three shuttle-car operators.
Shotfirer.
Two timbermen.

Mechanic.

Foreman.

The mining cycles of the single and double units are alike for all practical purposes.

The loading-cycle average is 0.43 min per ton. Shuttle-car capacity is approximately 2.33 tons. Each loader is followed by two shuttle cars. As soon as a place is cleaned up the timber crew moves in to ready the place for the cutting-machine crew. Posts are set on 7-ft centers 6 ft from the right and left of the center line, making roadways 12 ft wide. Crossbars and additional timbers are used where top is bad. In extremely bad top, 6x8x16-ft crossbars are installed. Roofbolts are not used.

After the place is cut the mobile hydraulic coal drill, operated by one man, drills six holes per cut. The drill is capable of drilling these six holes in approximately 3 to 4 min. One drilling machine follows two cutters and has drilled as many as 34 places, 8 holes per cut, in one shift. Even with this extra-heavy load the drill operator actually has spare time to help the shotfirer.

Equipment Maintenance—Three-shift maintenance goes hand-in-hand with three-shift production at the Laurel Fork mines. The company considers it a must to have spare units on each section to ease maintenance problems,

Periodic greasing is done on each shift by the section mechanic. Minor repairs are made on the spot. When equipment breakdowns cannot be repaired in a matter of minutes, a spare unit is moved in to keep the production cycle in balance. Spare units also are used on an exchange basis during the production shift to permit servicing of equipment.

Safety Program—The company has produced 3,578,423 tons of coal with 1,643,865 man-hours of exposure. The last fatality was in 1955.

Safety incentives and programs include:

1. Monthly drawing for a \$50 bond for classified employees who have not had a lost-time accident.

2. Monthly safety meeting for foremen.

3. On-the-section safety talks by foremen.

4. Safety education programs for foremen.

A new course has been completed by all supervisory personnel. It is the USBM's safety course entitled "Fundamentals of Coal Mine Accident Prevention for Supervisors."

Personnel Relations—In addition to management's philosophy regarding production, labor and mine cost, it also has established plans to benefit employees, as follows:

1. Improve personnel through testing and evaluation. These tests are being used to set personnel standards—not necessarily to evaluate individuals but to measure new employees. All employees, other than union members, take the tests.

2. Encourage employees to take home-study courses in mining engineering, foremanship and secretarial work. The company pays half the cost if the participant makes a grade of "C," and assumes the full cost for those who make a "B" or better.

3. Offer scholarships to students who have successfully completed first year of college. Students need not be children of employees. Scholarships are offered at Ohio State, West Virginia University, Virginia Polytechnic Institute and Penn State.

 Salaried and supervisory personnel participate in deferred profit sharing, pension and group insurance plans.

Create political responsibility among employees through political participation programs. Profit from the inside story on Roebling Royal Blue Wire Rope—the quality goes all the way through. Extra high strength in conjunction with uniformity of rope construction means unequalled resistance to wear and tear - and a whopping increase in service life. That is why every inch of

Roebling Royal Blue pays off on the job for you. Get all the details from your wire rope distributor, or write for free booklet to

Roebling's Wire Rope Division, Trenton 2, New Jersey.

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John A. Roebling's Sons Division The Colorado Fuel and Iron Corporation.



We put a lot of work into it - You get a lot of work out of it



Ask the man who changes the poi

...no one makes a tougher tooth than &CO

The right design, the right steel, the right shape make ESCO Two Piece Teeth right for every digging condition.

The earth moving industry looks to



ESCO Corporation

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See reverse for shapes and size range



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ESCO 12M Two Piece Teeth are the toughest you can use. Developed through years of research for the earth moving industry, cast ESCO 12M is the finest steel made for severe shock and abrasion.

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WEAR CAP ADAPTERS

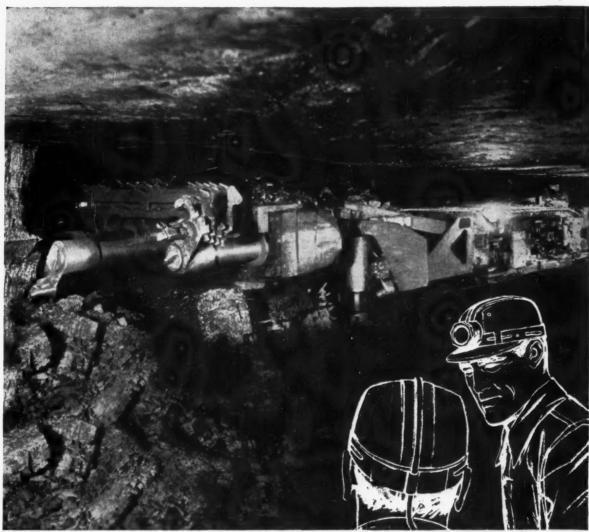
The ESCO Wear Cap Adapter, winner of the Blue Ribbon Mining Award, is the most rugged tooth assembly ever developed for handling tough rock and taconite. Replaceable wear caps sharply increase service life by protecting the adapter from wear. No special pins or welding required.



SHARP LONG SHARP



SHARP FLARED



A breakdown here could cost 1.25 tons per minute

A Texaco "Stop Loss" Program can keep it from happening in your mine.

A Texaco "Stop Loss" Program can lengthen equipment life by uncovering lubrication problem areas and recommending solutions-before the equipment breaks down. The program will also raise tons-per-man rates by extending intervals between overhauls. It may even help you slash over-all maintenance costs by as much as 10 per cent.

How Texaco's Program works: Texaco's "Stop Loss" Program is primarily concerned with getting the right lubricants into the right place at the right time. It involves a study of your requirements, an analysis of your special problems . . . finally, the selection of the proper

lubricants and the training of your personnel in their application. And it produces results.

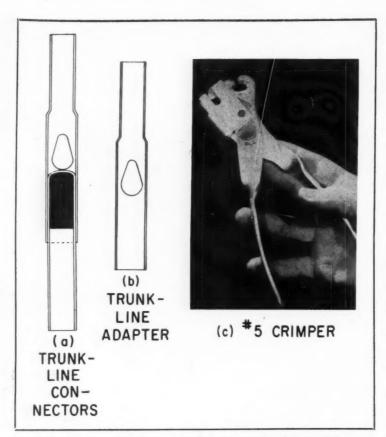
Ask your local Texaco Representative to prove what a "Stop Loss" Program can do for you. Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

Tune in: Huntley-Brinkley Report, Monday through Friday-NBC-TV

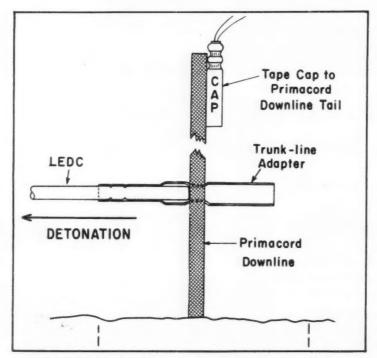
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COMPONENTS used with low-energy detonating cord include trunk-line connector (a), trunk-line adapter (b) and crimper (c).



INITIATING METHOD includes single cap taped to down-line tail, trunk-line adapter and low-energy detonating cord trunk line.

Reducing Blasting Noise Today

Application of a new explosive technique plus analysis of weather conditions can lead to fewer noise complaints at mines near populated areas.

YOU CAN do something about reducing blasting complaints today. New explosive usage techniques and evaluation of weather conditions are two useful tools for reducing complaints at mines near populated areas.

The public becomes aware of blasting by two physical sensations: vibration and noise. Since the short-delay blasting cap and connector were introduced, valid vibration complaints have been virtually eliminated. But operators frequently are plagued with complaints stemming from noise, which is frequently confused with ground vibration.

New Detonating Technique

By reducing the volume of noise produced you can do much to reduce complaints. Where detonating fuse is used to link a series of holes, most of the air-borne noise results from detonation of the trunk line. Some operators cover up trunk lines with up to 10 in of drill cuttings or dirt to reduce noise. But this takes time, is expensive and is only partly effective.

One solution to the air-borne noise problem is substitution of low-energy detonating cord (LEDC) for conventional detonating cord. Developed by the Ensign-Bickford Co. in a cooperative effort with duPont, 150 ft of the LEDC makes only about as much noise as one electric blasting cap or 2 in of reinforced Primacord. This low-noise detonating cord combines with other components to make a Low-Noise-Level Trunk Line Delay Blasting System.

A number of components are needed to make the system function, because low-energy detonating cord, unlike conventional, will not by itself initiate other LEDC trunk lines or conventional detonating-cord down lines.

Components of the LEDC system include a LEDC trunk line, delay connectors, trunk-line adapters and crimpers. The LEDC trunk line contains a lead tube loaded with 2 grains of PETN per foot. This tube is protected with counterings of cotton and plastic. Its outside diameter is 0.242 in.

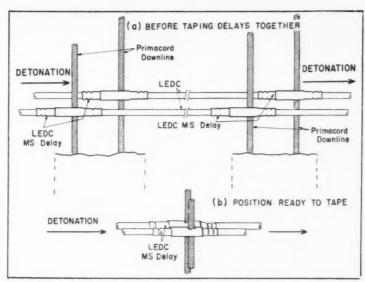
Trunk-line delay connectors are made up of trunk-line adapters and delay elements. They are available in 0, 10- and 15-MS delay intervals.

Trunk-line adapters are hollow copper sleeves which are used at the initiating hole only. A zero delay trunk-line connector also can be used for this purpose.

To cut LEDC and to crimp trunkline delay connectors and adapters to LEDC, duPont No. 5 crimpers are required. No other tool should be used.

Although very low noise level is its primary advantage, the low-noiselevel trunk line delay blasting system has several other advantages. For instance, it greatly reduces the hazards of premature detonation caused by stray current and static electricity. These hazards must be guarded against when electric blasting caps are taped to the down lines or placed in the holes. Furthermore, no electric caps are necessary until the shot is completely hooked up and ready to fire. Then one cap is taped to the down line of the first hole. The time, labor and expense of covering trunk lines where noise is a problem is eliminated. It gives a choice of delay intervals to meet the conditions of any blasting job. All the safety features of regular detonating-cord down lines in the blastholes can be retained.

Here is how the system works. An electric blasting cap at the first hole initiates the standard detonating-cord



HOW a single row of shots with two trunk lines and two down lines are connected (a) and position of lines ready to tape (b). Relay contains booster charge.

down line. This down line in turn initiates the LEDC butted against it in the trunk-line adapter.

The detonation wave travels along the LEDC trunk line to the next hole where it initiates the trunk-line delay connector. Inside the delay connector is a booster charge which initiates the regular down line at the second hole. The down line in turn initiates the LEDC in the trunk-line delay connector and detonation travels to the next hole, and so on until all holes are fired.

The low-energy detonating cord should be stored in an approved high-explosives magazine, the same as regular detonating cord. Trunkline delay connectors are similar to a blasting cap and therefore should be stored in a cap magazine. Since trunk-line adapters contain no explosives, they can be stored anywhere.

The LEDC system is not yet adaptable to more than two rows of holes, primarily because the delay elements will shoot only in one direction. It is also recommended that two trunk lines should be used in parallel as insurance against misfire. Although the LEDC system is not yet an ideal one, research is underway to simplify and improve it.

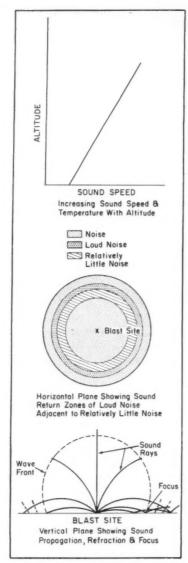
Weather and Noise

Weather conditions can cause an increase in sound propagation. Rec-

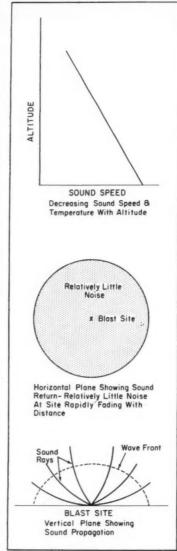
ognition of this fact resulted from a recent study by the New York Trap Rock Corp. They were convinced from a review of blasting complaints over a number of years that the noise propagation from some blasts was greater than others and found that weather conditions were the cause. For instance, when temperature inversions or isotherms prevail, blasting should not be done if it can be avoided. Normally, air temperature decreases about 3.5 deg F per 1,000 ft increase in altitude. But if temperature remains constant over a range of altitudes, an isotherm is said to exist. If the air becomes warmer as the altitude increases. then an inversion exists. By blasting only on those days that have favorable weather, complaints can be re-

Foggy, hazy or smoky days are the most unfavorable for blasting. If there is a nearby smokestack, check the behavior of the smoke. If it spreads horizontally after the initial rise, with little looping or vertical motion, a poor dispersion condition exists and, very likely, a temperature inversion.

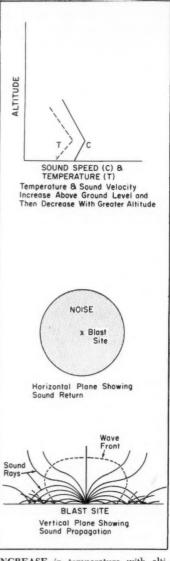
Meteorologists can predict isotherms or temperature inversion with considerable accuracy. If your local weather bureau is unable to provide information on these conditions, there are private meteorologists who may be employed. They usually can provide a forecast early



TEMPERATURE INCREASE with altitude results in zones of loud noise adjacent to area with relatively little noise.



TEMPERATURE DECREASE with altitude is the most ideal condition for dispersion of blasting noise.



INCREASE in temperature with altitude followed by decrease produces rumble of relatively long duration.

enough to postpone a shot until conditions improve.

Unfavorable Conditions

If you lack professional forecasts you can be on the alert for certain unfavorable weather conditions. They are as follows:

- 1. Relatively high atmospheric pressure that remains static more than 24 hr.
- 2. Wide daily temperature variations at the earth's surface.

- Poor visibility and light winds early in the morning followed by cloudiness.
- Light surface winds and low relative humidity at ground levels plus the presence of a stratified cloud deck below 10,000 ft.

Clear, somewhat hazy days with little wind and fairly constant temperatures are also unfavorable for blasting.

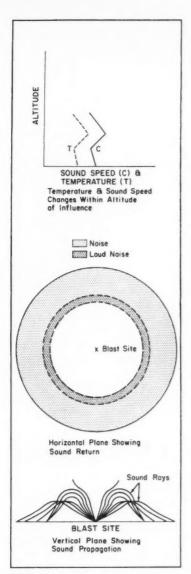
Favorable Conditions

Clear to partly cloudy skies with

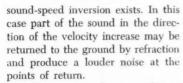
fleecy clouds and relatively warm day-time temperatures are favorable conditions for blasting. Cloudy days with rapidly changing winds, perhaps accompanied by brief showers also are favorable for blasting.

Weather conditions are important because they determine the velocity of the sound in different directions and at different altitudes. Wind velocity and temperature both influence sound propagation.

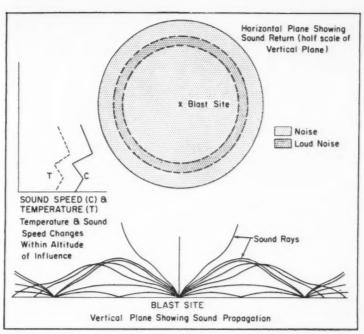
If the temperature and wind velocity are such that a greater sound velocity in any direction occurs above the earth's surface, then a



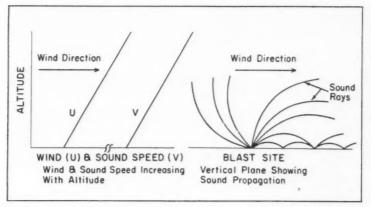
DECREASE in temperature with altitude followed by increase, then decrease results in loud zones far away.



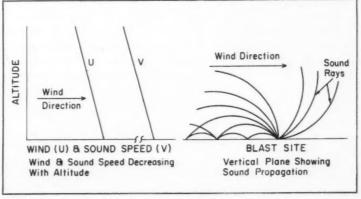
Different atmospheric conditions result in a variety of sound-speed patterns. When the temperature increases and decreases several times within 5,000 ft, patterns become more complex. If air temperature, for instance, increases for a short distance upward and then decreases with further height, no zones of silence will be present and the sound



THIRD sound-speed inversion produces rumble of relatively long duration near blast site plus zone of very loud noise.



POSITIVE wind gradient, has velocity increasing with altitude, produces the greatest noise return down wind from the blast site.



NEGATIVE wind gradient has velocity decreasing with altitude, produces the greatest noise return up wind from the blast site.



will be a relatively long rumble.

If air temperature decreases in the lower altitudes, then increases for a similar distance and finally decreases again within the altitude of influence, there will be little noise near the blasting site but there will be loud noise disturbance at more distant locations. There is a narrow zone in which the sound return is especially loud and sharp outside the relatively quiet zone. Beyond the zone of very loud noise, other sound rays return to the ground, but are lower in intensity and sharpness.

A third common sound-speed inversion is one in which, with altitude, the temperature successively increases, decreases, increases once more at a greater rate and finally decreases. In this case, there is a zone of noise surrounding the blasting site and traveling in all directions. The noise in the zone nearest the blast site will be a rumble of relatively long duration.

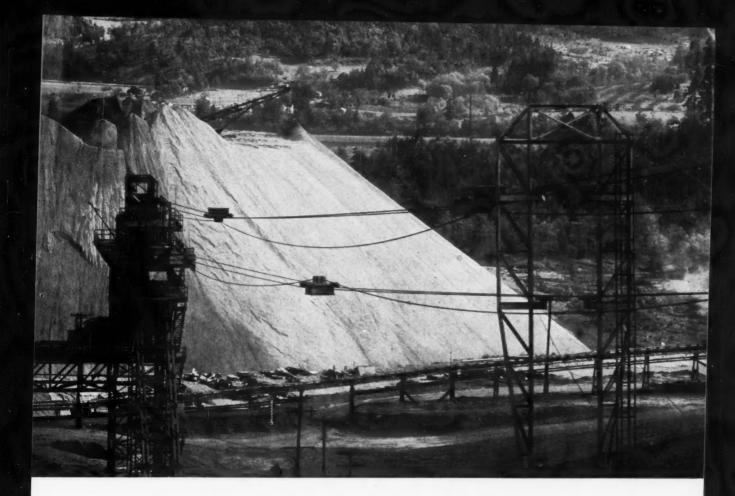
This atmospheric condition also results in a zone of very loud noise. In this zone several sound rays return to earth at the same time and are reinforced by rays that have traveled a shorter path and been reflected from the ground.

Wind alone also plays an important role in noise distrubance, depending on whether the wind velocity increase with altitude the greatest noise disturbance is down wind from the blast site. But if wind velocity decreases with altitude the greatest noise return is up wind.

Some scientific studies minimize the effect of wind on return of sound. But studies by duPont reveal that complaints can be reduced by refraining from blasting when winds are directed toward populated areas. Bureau of Mines research also confirms this observation. Although the effect of wind can not be discounted, temperature effects are believed to be more critical.

Study wind velocity and temperature on the days when blasts are planned to determine if the noise return will be excessive. Remember that one of the most critical times from the point of view of noise return is when the air is relatively still.

This material was derived from two bulletins from E. I. duPont de Nemours & Co. as follows: Let's Reduce the Noise From Blasting and Low Noise Level Trunk Line Blasting System.



Aerial tramway moves a million tons of ore every year

2½-ton capacity ore cars ride smoothly on Bethlehem track strand

In a rugged section of Oregon's Coast Range, The Hanna Mining Company works the only nickel mine now operating in the United States. On top of Nickel Mountain the ore body lies right on the surface; the open-cut mining method is used.

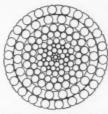
It's 8,300 ft from the loading terminal at the upper level to the smelter stockpile at the foot of the mountain and there's a drop of some 2,000 ft in elevation. A continuous aerial tramway was selected as the most economical way to move the crushed ore downhill over this difficult terrain. The tramway is equipped

with 63 ore cars which carry $2\frac{1}{2}$ tons each. Rated capacity is 250 tons per hour, feeding over a million tons a year to the smelter.

50,000 ft of large track strand and wire rope used

Unlike a monocable aerial tramway, the ore cars ride on two pairs of Bethlehem track ropes. The upper pair is 2-in. diameter strand, while the lower is 1½-in. diameter locked-coil track strand. This type of track strand has a smooth surface for the carriage wheels, holding vibration to a minimum as the tram car runs over it. It is designed to resist bending and crushing stresses, too, and takes abrasion remarkably well. Altogether, 16,920 ft of each size

strand is involved, as well as 16,640 ft of 2-in.diameter Bethlehem Purple Strand wire rope for haulage lines.



Half-locked coil strand is designed to be flexible, yet strong. The 2-in,-diam strand has a minimum breaking strength of 218 tons,

If you would like to know more about wire rope for aerial tramways, simply get in touch with the nearest Bethlehem sales office. They'll be glad to give you full details.

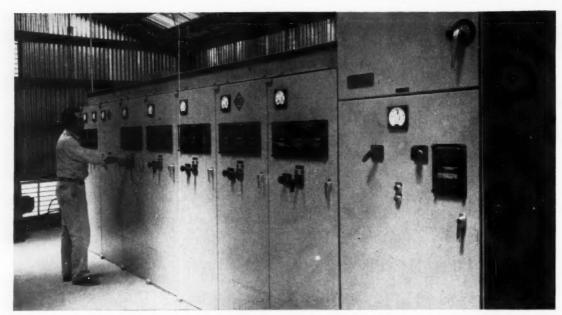


There's a distributor of Bethlehem Rope near you, supplied by our nationwide network of wire rope mill depots.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL





LINSTALLATION at a mining property employs typical metal-clad switchgear in 4.16-kv service.

Selecting Protection For Intermediate Voltage Service

Which will it be . . . Fuses or circuit breakers?

Stanley E. McDowell Switchgear Dept. Allis-Chalmers Mfg. Co.

DISTRIBUTION SYSTEM ENGINEERS responsible for specifying plant circuit switching and protective devices may at one time or another be confronted with the necessity of deciding whether to use circuit breakers or fused interrupters for 2.4-kv through 13.8-kv service.

Both the circuit breaker and fused interrupter have proper fields of application and there are certain guideposts which can be helpful in making an economical and sound engineering choice.

Fused interrupters are particularly adaptable for such light duty applications as switching and shortcircuit protection of service entrances, feeders, small power and lighting transformers, and load center substations where faults (as indicated by experience or nature of plant processes) are expected to be infrequent.

In most industrial plants or commercial and institutional buildings, circuits are either indoor or completely underground and feeder cables are not exposed to faults caused by lightning, wind, etc. Therefore, failures which do occur generally result in relatively serious damage and the time needed to change a blown fuse is insignificant to that needed to make other repairs.

On the other hand, circuit breakers are better adapted to applications where faults are likely to happen more frequently and are of a transient nature. Also, where plant processes dictate an absolute minimum down time or where complicated relaying and sequential interlocking schemes (such as power house auxiliary service or unattend-

ed pumping stations) are involved, circuit breakers are the only choice.

Fuses less complicated

Since the fused interrupter is a far less complicated device, its initial cost is anywhere from 50 to 75% of that for switchgear depending upon the accessories required and whether it is an indoor or outdoor unit. However, the circuit breaker is more flexible and provides greater continuity of service.

The somewhat more complicated mechanisms of the circuit breakers and their associated devices require some maintenance while fused interrupters will operate for years with relatively little maintenance.

When a fused interrupter clears a short circuit, the switch is not affected and it is only necessary to replace the fuse. Generally, it is a good idea to replace all fuses because of possible damage to unblown units. In the case of circuit breakers, NEMA standards recommend that a breaker be checked as

soon as possible after it has interrupted a short-circuit fault.

Breakers feed larger loads

Circuit breakers are capable of feeding larger loads than fused interrupters. The maximum load fed by a fused interrupter is dependent upon the fuse rating. Load limitations for fused interrupter and air circuit breakers are shown in Table I.

The more versatile cricuit breaker can also accommodate higher interrupting capacities than fused interrupters, which are not particularly suited for overload protection, nor can they be relayed as extensively as circuit breakers.

Fuses are 100% rated devices. That is, they can carry their rated current continuously but have very little overload capability. Since the element melting point is approximately 200% of its rated value, fuse overheating and resultant damage can occur in the 100 to 200% range. Fig. 1 illustrates allowable short time overloading permissible without impairing fuse operation.

If fuses are properly applied, overloading should not occur. Circuit breakers are rated 1,200 amp continuous and in most normal applications would be on circuit with full load currents of 400 to 800 or even 1,000 amp. Thus by adjusting relay settings, breakers could carry circuit overloads for extended periods with no impairment to operation.

Fused interrupters cannot be used on repetitive duty. When a fault occurs and the fuses blow to isolate the faulted circuit, the interrupter switch has not opened and the blown fuse or fuses must be manually replaced before reclosing can be accomplished. Circuit breakers with proper relaying can be reclosed instantaneously.

Fuses faster on shorts

While air circuit breakers have a normal rated interrupting time of 5 cycles (60-cycle basis) and can be obtained with interrupting time of 2 cycles, fuses operate within the first half cycle on short circuits, but are generally slower than relays on overloads.

There is a possibility of single

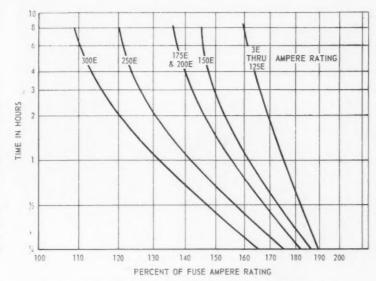


Fig. 1-ALLOWABLE short-time overloading of representative fuses.

TABLE I-Load Limitations

	Fused into	errupter	Air circuit breaker				
System Voltage, 3-phase	Power Fuses am		1,200 amp	2,000 amp KVA —	3,000 amp		
2,400	1,000	500	5,000	7,500	12,000		
4,160		1.000	7,500	12,000	20,000		
4,800		1,000	10,000	15,000	25,000		
7,200		1,500	15,000	25,000	37,500		
12,470		1.500	25,000	40,000	60,000		
13,200		1,500	25,000	40,000	60,000		
13,800		2,000	25,000	40,000	60,000		

phasing on circuits protected by fused interrupters. On overloads or short circuits, only one fuse may blow, resulting in single phasing with damage to improperly protected motors or other equipment. On pneumatic or motor-operated switches, single phasing can be eliminated by relaying to open the switch when a fuse blows. Fuse "sneakouts" due to vibration, aging, etc., can also result in single phasing.

Fuse time-current characteristics are less accurate than relay-controlled circuit-breaker tripping characteristics with the result that coordinated circuit protection is more difficult and generally less reliable.

While current limiting fuses are quiet in operation, power fuses (expulsion fuses) are very noisy and emit hot are gases which must be vented. Air circuit breakers have very slight noise and emit some gases.

For the most part, circuit breakers are safer than fused interrupters be-

cause of the lack of compartmentation in the fused interrupter housings and because of the possibility of fuse rupture when blowing. There is also the chance of installing an incorrectly rated fuse as replace-

Both air circuit breakers and fused interrupters equipped with quick-make, spring-charged closing devices can close at high speed on a short circuit without danger to operating personnel. However, circuit breakers can switch full load current many times more than an interrupter switch.

The drawout fused interrupter has many of the features of metalclad switchgear. Fuses and switch are removable from the cubicle and provide a disconnecting means; shutters cover the access openings to the stationary mainstuds and compartmentation similar to but not as extensive as switchgear is used.

Like switchgear, both stationary and drawout fused interrupters can



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be obtained with weatherproof housings suitable for outdoor locations. Fused interrupters generally occupy from 60 to 75% of the floor space area required by metalclad switchgear except for the drawout fused interrupter which uses nearly the same floor area as switchgear.

Both in same circuit

The compatability of switchgear and fused interrupters is borne out by the fact that both can be installed in the same line-up on systems having various types of loads. Some loads on the system may dictate use of circuit breakers while others, such as lighting transformers, would need only a fused interrupter. A circuit breaker may also be used as a main breaker feeding a group of fused interrupters.

There is no firm agreement on the choice of circuit breakers over fused interrupters or vice versa but the considerations mentioned should be helpful in making the most effective selection for conditions peculiar to your plant.

Biggest Bargain

The next issue of *Coal Age*, in December, will bring to an end another year of service to coal-mining men. Again *Coal Age* provided nearly a thousand pages of news of new developments and outstanding accomplishments in deep mining, strip mining, preparation, safety and supporting services. This is equivalent to half a dozen thicker-thanaverage books, making *Coal Age* the biggest coal-information bargain going.

Seven features coming in December will bring the total for 1961 to 103 covering all the 21 major mining functions. One of these seven highlighting the December number will be another Operating Guide created by Coal Age. "Fine-Coal Treatment and Water Handling" is the title of this—the sixth in the series. Past guides included:

Mine Storage of Coal—Dec., 1959 Coal Screens and Screening—April, 1960

Cutter and Drill Bits—Sept., 1960 Belt Conveyors and Belting—Dec., 1960

Lubricants and Lubricating Equipment-May, 1961



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(out of one, many)

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Maintenance Ideas

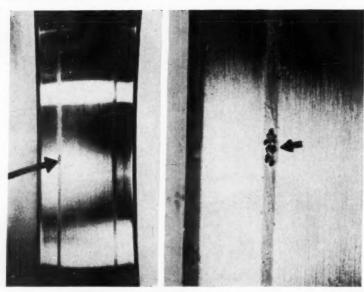


FIG. 1-INCIPIENT FLAKING of a self-aligning ball bearing.

Bearing Failures and Their Causes

It is important to correctly determine the causes of bearing failures. The more reliable your conclusions, the greater are your chances of being able to avoid a repetition. It is better to know exactly what caused a breakdown and to avoid another later on than merely to receive a new bearing free of charge. Though the latter alternative may satisfy the immediate requirements from a business point of view, it usually leaves the root of the evil untouched. The objective of this article is to help you eliminate the root of evil.

BALL AND ROLLER BEARINGS are much more reliable and require far less attention than other bearing types. The principles governing their use are quite different from those applicable, for example, to plain bearings. Recognition of this fact is essential if all the advantages of ball and roller bearings are to become realities.

The performance of a machine often depends on whether or not the causes of its failure are correctly understood. And since bearings are among its most vital components, the ability to draw the right inferences from bearing failures is necessary. This article, "Bearing Failures and Their Causes," which appeared in Motion Research and Engineering, published by SKF Industries,

Inc., Philadelphia, covers this subject well. It is presented here in condensed form to give you a better understanding of the causes of bearing failures and how and why these failures occur—the first step to greater bearing life and better machine performance.

The Nine Major Causes

The first step in selecting bearings is to decide which type and size shall be used. The choice, generally, is based on a certain desired life for the bearing. The next step is to design the application of the chosen bearing with due allowance for specific service conditions. Unfortunately, bearing life, commensurate with quality, is not always attained.

Bearings do fail prematurely. Most failures can be attributed to one or more of the following causes:

- Malformation of bearing seatings on shafts or in housings.
- 2. Misalignments.
- 3. Faulty fittings.
- 4. Wrong fits.
- Inadequate or unsuitable lubrication.
- 6. Defective sealing.
- 7. Vibration while the bearing is not rotating.
- 8. Passage of electric current through the bearing.
- Defects of material and errors of manufacture.

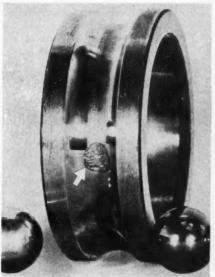
When the life of a ball or roller bearing draws near, i.e., as soon as incipient fatigue sets in, a minute patch of flaking makes its appearance on the bearing tracks or races. Fig. 1 shows how flaking appears in a self-aligning ball bearing. From the enlargement on the right it can be seen that the patch consists of a number of small pits in the track. A bearing affected in this way announces the fact by becoming noisy.

Once this flaking starts it spreads with considerable rapidity and is capable of reaching the proportions of those seen in Fig. 2 in a short time. Once it has gone this far, total destruction of the ring, together with that of the bearing as a whole, can only be prevented by removing the bearing. Fig. 2 shows flaking on the inner rings of two single-row ball bearings. On one the flaking is still localized but on the other it extends around the ring.

Failures Due to Malformation of Bearing Seatings

Information on carrying capacity supplied by the makers of ball and roller bearings presupposes that the comparatively thin race rings will be fitted on or in seatings that are as cylindrical as modern machineshop technique allows. Owing, however, to variations in methods of production or to the use of machine tools of inadequate precision, many of the bearing seatings produced in practice often leave room for criticism.

In the outer ring of a bearing, for example, flaking can set in at







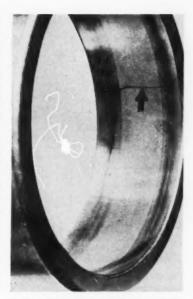


FIG. 3—FATIGUE CRACK from faulty contact between ring and housing.

two opposite parts of the track. This can only happen where the bearing seating in the housing is oval, a fault mostly occurring in split housings. If the machining of the bearing seating in a housing of this design, or that of the joint faces, is not correct the bearing is liable to be badly distorted when the bolts holding the two halves of the housing together are tightened. Flaking also can occur where the contact between a bearing outer ring and the housing is inadequate or uneven.

When the contact between a bearing ring and its seating is not as intimate as it should be, yield in the ring commonly results. This is attended by small movements of the ring in relation to the housing or shaft which give rise to what is called "fit rust."

Fit rust can also be found in application where the machining of the seatings is made with the utmost accuracy but where, because of service conditions, the seatings under load are subject to deformations. Experience has shown that this type of fit rust on the outer rings does not, as a rule, detrimentally affect the life of the bearing.

Another kind of malformation of bearing seatings is in their being curved in one way or other in an axial direction. With the surface of a seating having this fault, a bearing ring cannot make contact throughout its width. The ring therefore yields under load and as a result fatigue cracks running lengthwise along the track commonly make their appearance. Such cracks caused by faulty contact between two rings and the respective housings are shown in Fig. 3.

The carrying capacity of a bearing can only be utilized to the full when its rings are provided with seatings machined with the highest accuracy. The inherent rigidity of rings is quite inadequate to prevent major alterations in form in the face of the forces resulting from uneven contact. The carrying capacity of a bearing is therefore adversely affected by the use of a housing with walls that do not remain rigid during application of the load. For this reason, among others, care must be exercised in fixing the dimensions of housings to preclude all possibility of

Misalignments

These errors are a prolific source of premature bearing fatigue. They are exemplified respectively by a shaft shoulder that is not square with the bearing seating and by two housings containing bearings supporting the same shaft but in which the bearing seatings are not in line with each other. The face of a shaft shoulder should always be perfectly

square with the bearing seating because the position the inner ring assumes on the journal is determined not only by the fit between its bore and the journal, but also by the axial support provided. If the face of a shaft shoulder or distance ring is not square with the shaft, a bearing ring on being applied to it under heavy axial pressure is bound to adapt itself to this condition and not only the carrying capacity of the bearing but also its running suffers in consequence. This is true of all bearings that are not self-aligning and above all of cylindrical and taper roller bearings because of the edge-loading entailed.

The angle formed with the shaft by locating surfaces is no less important where thrust bearings are concerned. The balls in a thrust bearing share the load equally if that part of the track to which the load is applied on one washer lies in a plane parallel with that in which the corresponding part of the other washer lies. If these two planes are not parallel a few of the balls are bound to be saddled with the entire load. The specific load in the affected zone will exceed that obtained by calculation and the stationary washer will be constantly overloaded at one and the same place and will in consequence develop fatigue much sooner than if the load were evenly distributed.

Maintenance Ideas



FIG. 4-FLAKING caused by edge loading, a result of bearing misalignment.



FIG. 5-SMEARING caused by too solid a lubricant as well as over lubrication.

If the bearing seating in the housing is not square with the bearing axis, trouble can be avoided by mounting the stationary washer on a spherical seating washer-though not if the locating shoulder on the shaft is out-of-square with the bearing seating. If the rotary washer is not square with the axis of rotation, it wobbles, and the stationary washer must in consequence be continually readjusting itself on the spherical seating washer. Since the movements thus executed involve sliding between two practically dry surfaces. wear is inevitable and cracks gradually make their appearance.

If the washers of a thrust bearing are not strictly parallel, the balls when passing from the loaded into the unloaded zone are likely to cause damage. This damage which appears as spiral markings on the track of the affected ring is caused by the gyratory forces encountered.

This action is called smearing and results from a sliding movement causing material to be detached from one surface and firmly affixed to another. It also is fairly common where the load is shared equally by all the balls in the bearing, even where no fault can be found with the fitting. In such bearings the spirals are distributed all around the track and are formed when the load on the balls falls short of a certain minimum in relation to the speed of rotation.

This required load increases with

the square of the peripheral velocity. At low speeds a comparatively light load suffices to ensure that the balls will roll properly but at high speeds the load normally imposed on the bearing during operation is often too light to have this effect in the face of the gyratory forces encountered.

Spiral shaped smearing therefore is practically confined to thrust bearings operating at high speeds. This fact, incidentally, explains the preference now shown for radial bearings as the means for dealing with thrust loads where the speed is at all high.

Where the bearing seatings in two housings support the same shaft but do not have a common centerline, only self-aligning ball or roller bearings will be capable of functioning without setting up bending moments, i.e., self-alignment is necessary to neutralize the effects of this error. In the operation of cylindrical and taper roller bearings it is compensated, to a small extent, because of a slight camber on the outer ring track of the majority of such bearings. If the misalignment is very edge-loading results-a cause of early flaking. It was responsible for the flaking in the bearing ring shown in Fig. 4.

If edge loading is to be avoided in a rigid ball or roller bearing—one that is not self-aligning—its two rings must as far as possible lie in the same radial plane. This means that their seatings must be as nearly

parallel as possible and that the angle between the seatings and the axial abutment surfaces must approximate a right angle as closely as possible. If these conditions are not satisfied, the life of the bearing will fall far short of its estimated life.

Damage Due to Faulty Fitting

The fitting of bearings is another field in which future trouble can develop. The causes of failure include neglect to observe the necessary cleanliness which unfortunately is quite common, and is responsible for wear and other damage which often necessitate early replacement. Careless handling of a bearing during mounting also is a potential cause of bearing failure. Flake patches, for example, which follow one another at intervals corresponding exactly to the distance between the balls indicate that their origin was derived from blows sustained by the outer ring when the bearing was fitted on the shaft. The resulting stresses at the points of contact between balls and track suffice to cause depressions in the track which form the nuclei of the patches of flaking. Many bearings thus affected are rendered recognizable as such by noisy running which attracts attention as soon as the machine is started up.

Flaking due to fatigue of the material sets in much earlier than it should if the bearing is exposed to supplementary loads not envisaged in the planning of the bearing arrangement. Such loads include that imposed when a shaft supported by two bearings lacks sufficient scope for expansion. The deficiency is one of the results of fautly fitting.

Damage Due to Wrong Fits

To ensure a bearing ring the right fit on the shaft or in its housing, the direction as well as the magnitude and character of the load must be taken into account. If the direction varies in relation to the ring or if the ring rotates in relation to the direction of loading, a tight fit must be employed since the ring might change its position on the shaft or in the housing. These movements are called "creep" and are executed under a heavy load and in the ab-



FIG. 6-WEAR due to vibration while bearing is stationary. Wear is equally spaced around the track.



FIG. 7-FLUTING due to passage of electric current through a bearing. Damage due to this cause is rare.

sence of lubricant which causes wear of the contact surfaces.

Wear of the ring bore due to creep is accompanied by wear of the shaft. The wear reacts on the creep and accelerates it, thus setting up a vicious circle. Minute particles of steel set free in the process find their way onto the balls and tracks with the result that these also become worn. When unsatisfactory performance eventually compels an investigation it is often found that not only the bearing but the journal as well is ruined and that renewal of the former no longer suffices for doing away with the trouble.

In the choosing of fits it is also necessary to avoid the other extreme. Fits that are too tight can cause radial compression of the balls and rings.

Damage Due to Inadequate or Unsuitable Lubrication

The consequences of unsuitable lubrication often show themselves soon after the machine has started running and if the warnings are heeded promptly, the faults to which they call attention can usually be stopped before they have had time to cause any damage.

Lack of a lubricant is revealed by a whistling sound coupled with a rise in temperature, though the latter is sometimes a sign of over lubrication. Failure to remedy these faults is likely to produce damage of many different kinds. Intense overheating, for example, is capable of neutralizing the effect of the initial hardening. Lack of lubricant may cause wear of the cage, accompanied by

smearing of the tracks and rolling elements with cage material detached in the process. Wear of the bearing as a whole also results from inadequate lubrication. The first parts to be affected are those subject to sliding friction, such as the faces of the locating flanges and the end faces of the rollers in a roller bearing.

Grease or oil that is too thick is capable of producing a braking effect strong enough to make the rolling elements slide on the track when they pass from the unloaded to the loaded zone. This is more likely to happen when the bearing is large and rotates at high speed.

Smearing due to this cause often escapes detection until the bearing arrangments are overhauled because the conditions responsible for its spreading cease to exist when normal running speeds are reached. However, bearing life is shortened. If the bearing is lubricated with too thick a lubricant and also is overlubricated the smeared patches are capable of becoming as large as those in Fig. 5.

Damage Due to Defective Sealing

One of the more common causes of bearing failure is inadequate sealing which enables dust and particles of dirt to enter the bearings, thus causing wear of the tracks and rolling elements. This wear appears as a fine uniform matte finish on the contact surfaces.

A felt washer cannot by itself afford adequate protection to a bearing operating in an atmosphere charged with abrasive dust and is still less capable of meeting the requirements where dampness prevails or water has access to the bearing housing. Good sealing often receives too little attention.

Wear caused by foreign matter in the bearing makes its appearance earliest on those parts where sliding of one sort or other takes place as, for example, on the end faces of the rollers in a cylindrical roller bearing. Rust particles which are formed under the influence of moisture in the bearing housing also attack the surface of tracks and rolling elements. The rust mixes with the lubricant in the bearing and causes considerable wear.

If damage of this type is to be prevented the bearings must be protected against moisture at all times, not only during operation but also while they are being fitted. If a machine is very much exposed to water and in spite of the use of well-designed seals, difficulty is experienced in providing its bearings with adequate protection, recourse may be had to the use of a lubricant that can absorb a certain amount of water and thus prevent the formation of rust. Unsuitable lubricants are capable of causing rust in a bearing.

Damage Caused By Vibration

Exposure of ball and roller bearings to vibration while standing idle is a cause of bearing failure, although an infrequent cause. Due to the variation of the load under these circumstances, minute sliding movements take place where the rolling elements of such bearings are in contact with the tracks. Small particles

of material are set free from the contact surfaces and immediately oxidized. The patches of wear thus produced are recognizable as being due to this cause. The wear on the tracks are separated by a distance equal to that between the rolling elements. A typical example of damage due to this cause is provided by the thrust bearing shown in Fig. 6. Because of true wear this damage can be sustained by a bearing ring even if the forces active during vibration are much smaller than those corresponding to the static carrying capacity of the bearing. The magnitude of the load is not without influence for it varies more under the influence of stronger forces with the result that the extent of the sliding between the contact surfaces is also increased

Damage Due to the Passage of Electric Current Through Bearings

Short circuiting of heavy currents through a bearing can cause burning and craters due to arcing and melting at the points of contact. However, repeated passage of even weak currents can sometimes produce effects as shown in Fig. 7.

If the current acts on a bearing for a short time—during a shortcircuit— a number of small craters are formed and if the current is alternating the craters follow one another along the track in a manner suggestive of a string of beads.

Since the harmful effects produced by the passage of electric current through bearings became known, the makers of electrical machinery have provided for the use of suitable current diverters where necessary. As a result, damage due to this cause is rare.

Damage Due to Defects of Material and Errors of Manufacture

When a ball or roller bearing becomes damaged and the cause is not immediately apparent, suspicion often falls on the material or manufacturing methods. In the majority of cases, however, an examination carried out with some knowledge of the more common causes of bearing failures will leave little doubt as to the true cause of the damage. Re-

search has proved that both the material and methods of manufacture, and checking employed in the production of ball and roller bearings have reached such a state of development that defects in the bearings are rare. However, these possibilities exist and they include defects or flaws in material such as a slag inclusion, or errors in manufacture such as overheating during grinding which may result in fine cracks. Defective hardening is an extremely unusual occurence and is easily revealed by a porous condition which develops after a short period of bearing use.

When cracks running parallel with the shaft are found in a bearing ring the inference is sometimes drawn that the cause is due to the ring having been driven up too far on its seating. The actual facts, however, usually fail to substantiate this view because the stress produced in mounting the ring, even if the maximum permissable journal limits are exceeded, is much less than that corresponding to the tensile strength of the ring. All the same, it is possible for cracks to be caused by errors in manufacture. The presence of grinding cracks is revealed by etching. after which the parts that have been exposed to too high a temperature are darker in color than the rest of the ground surface and are easily distinguishable.

The hardness of bearing components has occasionally been the subject of criticism. The truth, however, is that defective hardening is a very exceptional cause of failure. When a bearing ring has not been sufficiently hardened, its track acquires a porous appearance after quite a short period of use.

The causes of the great majority of bearing failures discussed are directly or indirectly related to the design of the bearing arrangement as a whole. Inadequate sealing, for example, is capable of ruining an otherwise faultless design. Bearing fits that are not as tight as they should be are often found to have been chosen because the right ones would have rendered fitting or dismantling more difficult. Other conditions for which the design of the bearing arrangement cannot be held responsible are faulty machining of shafts or bearing housings, faulty fitting, or wrong treatment during



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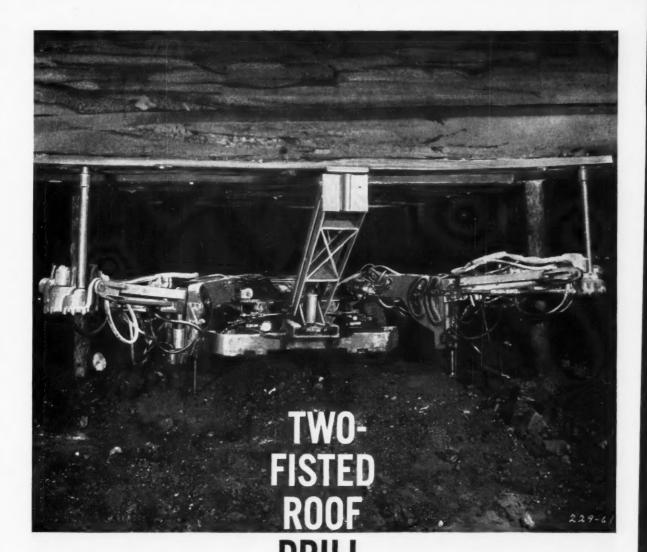


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For further information on any of these cables, or any other type of mining cable, contact Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-CA



the results of equipping a pickup truck with a laboratory sampler for preparing coal samples in the field for analysis in the laboratory.

The Ringgold Coal Mining Co., Kittanning, Pa., a coal-brokerage company, purchases coal from a number of strip and deep mines. As a coal broker, it must assure its customers that the delivered high-volatile coal meets Btu specifications regardless of the mine or mines from which it comes. The company sells primarily to power companies in Pennsylvania, northeastern United States and Canada. Approximately one-third of the coal goes to Canada. Ringgold does not actually mine coal but it does provide engineering and legal services to its independent suppliers.

All analyses are performed by independent laboratories. The big problem, however, was to collect samples from mines and preparation plants which are spread over a large area. The volume of coal that had to be sampled created an economic problem. For example, the tonnage of coal hauled for sampling purposes alone was extremely high. The cost per sample also was high, considering that coal delivered to the labs had to be crushed and split and then analyzed by independent concerns.

Mobile Sampling

Ringgold wanted to achieve onthe-spot coal crushing and splitting which would produce an immediate sample of the coal for analysis at independent laboratories. They wanted a mobile crusher to serve all the mines and plants.

The company contacted the Sturtevant Mill Co., Boston, Mass., manufacturers of coal-crusher samplers and splitters, to determine what could be done to achieve on-the-spot sampling.

The Sturtevant sampler is powered by a 3-hp electric motor which limits its application to permanent installations where power is available. However, Myron A. Shoffner, consultant, Riggold Coal Mining Co., adapted a gasoline engine to the sampler, which made it completely portable and self powered. It was then mounted on a 34-ton pickup truck which permitted sampling coal at all locations with speed and accuracy.

Preparing Samples

Approximately 75 lb of coal are used to produce a 3½-lb sample. The sampler crushes the coal and diverts 5, 10 or 15% to an automatic splitter which further splits the sample to 5, 10 or 15% of the initial sample. Diversion of the initial sample directly from the feed produces a better-than-average representative sample.

The sampler is capable of crushing up to 3-in coal and reducing it to 6 mesh with a large percentage of 20 mesh and finer. The sampler has a capacity of 1 tph.

The coal is first crushed by a revolving coarse-crushing nut and stationary top liner. This coarse coal is then passed through a fine-toothed crushing disk and stationary liner. The two-stage crushing method produces a thoughly mixed, and finely crushed, cross-sample of the 75 lb of coal. The remaining coal is discharged and returned to the source.

All samples are contained in screw-top metal cans which are sealed to keep samples chemically stable, thus preventing loss or pickup of moisture between sampling and analysis.

Sampling Schedule

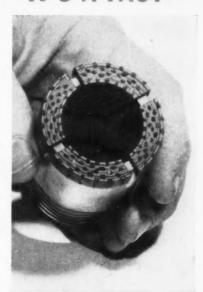
The success of the truck-mounted sampler has prompted the company to investigate the economic feasibility of sampling at points-of-delivery for local customers and at points-of-shipment for distant customers. This would provide on-the-spot moisture and ash content analyses.

The mobile unit can sample at the company's five most distant suppliers and preparation plants in a working day, allotting 90 min between stops for crushing as much as ½ ton of coal at each place. This ½ ton yields 150 lb of the initial sample which is further reduced to about 7 lb for lab analysis.

The sampling schedule may vary from day to day. The truck, for example, may remain at a single mine for one day taking channel and mined-coal samples, and for making other tests. An entire day may also be spent at a plant checking deliveries, blends and shipments.

All procedures are directed at improving quality control and providing more samples at a lower cost per sample.

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says Fred Newkirk, Manager of Materials Transportation Company, Inc., Corpus Christi, Texas

"We are using Ford Trucks exclusively because they provide important savings—starting with a lower initial expenditure. We estimate that each Ford costs us about \$1,500 less than other makes of comparable size and capacity. Our maintenance and repair costs are less, too. The greater parts interchangeability on Ford Trucks makes it possible to reduce our parts inventory by about 50%; this frees \$2,500 of working capital. And in operating expenses, we save on gasoline because our Fords deliver an extra ½ mile per gallon.

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160,000 miles without even having the heads or pan off. We expect 200,000 miles from these Super Duties before a major overhaul. Some of our 1955 and 1956 Ford F-900's still have their original brake linings after 300,000 miles.

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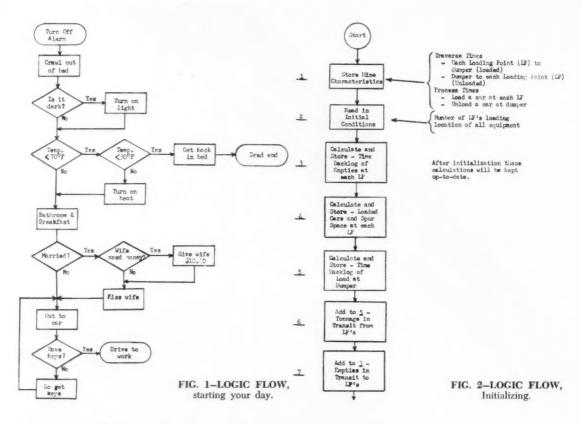
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COAL AGE · November, 1961



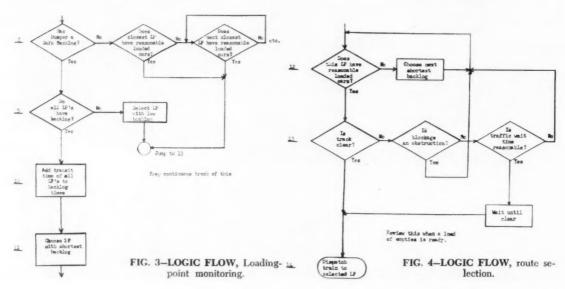
Mine Haulage Automation

R. L. Houlton,

Manager-Process Automation Engineering Industry Control Dept. General Electric Co., Salem, Va. BY WAY OF DEFINITION, the elements of mining can be broadly listed as follows:

1. Cutting and loading or other means of removing the material at the face

- 2. Conveying the material from the face to a loading point.
- 3. Loading the material onto mine cars for underground haulage.
- 4. Hauling the material to a processing or hoist loading point.



- 5. Dumping the material out of the hopper cars into surge bins.
- In the case of many mines, loading the hoist and hoisting the material to the surface.
- 7. On the surface, conveying the material to the processing plant.
- 8. Processing the material; that is, screening, cleaning, washing, dewatering, crushing, blending, etc.
- Conveying the prepared material to storage piles at the loading point.
- 10. Loading the material into barges or railroad cars for shipment to destination.

Obviously any given installation may not include all of these functions. Also each of the individual functions may be automated, aumated partially, or not at all. It often makes sense to apply automation progressively to one function at a time. However, it is important that an overall automation plan be formulated for the complete mine before initiating automation of a single function. The application of automation to each of the mining operations individually without thought for what may be done in the future in an adjacent area can be quite dangerous. It may make subsequent steps more expensive or even force them to become economically impractical.

For the purposes of our consideration, we would like to concentrate on the areas having to do with underground haulage covering car loading, line hauling, and car dumping.

The "Automation Concept"

The average person's concept of automation encompasses the replacing of people with machines. Actually automation is a word that can be all things to all people. We think of it in terms of four functions:

1. Mechanization by which a machine is modified so that it can be automatically adjusted for changing conditions, or machinery is added so that material can be conveyed from one place to another.

An example of mechanization is

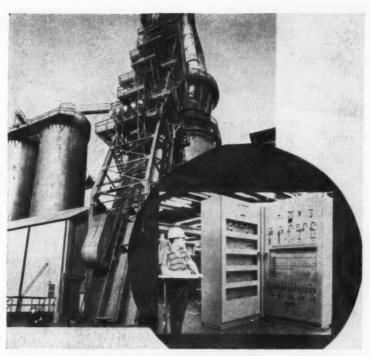


FIG. 5-BLAST FURNACE charging-program control.

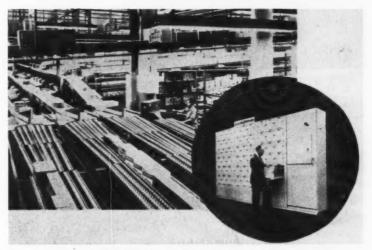


FIG. 6-DISTRIBUTION WAREHOUSE order-picking control.

the automatic operation of poweroperated track switches replacing manual switches to direct traffic.

2. Feedback regulators which are added to measure the work being done, compare the results to a standard reference, and automatically make adjustments to assure desired operation.

An example of a feedback regulator is measurement and automatic control of the haulage speed.

3. Interlocking and sequencing

which are used to cause operations to be performed in a prescribed order or to check the operation to make sure that limits are not exceeded that would damage equipment or material.

An example of sequencing is the automatic programming of the functions required at the car loading area. An example of interlocking is automatically keeping track of the number of cars on the spur at the loading point to make sure it does not become over-filled.

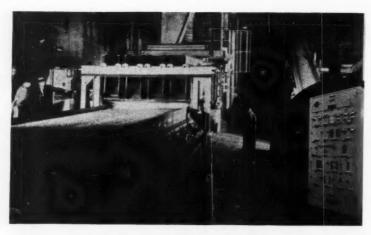


FIG. 7-SINTER PLANT material-flow control.

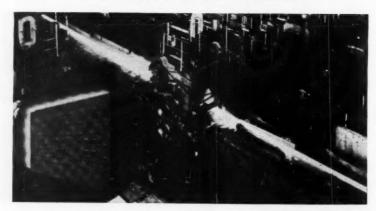


FIG. 8-STRUCTURAL MILL program control.

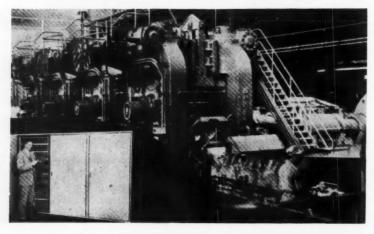


FIG. 9-HOT STRIP MILL computer control.

4. Decision-making which is applied to monitor the operation in process and change the set points on the regulators, or the order of prescribed sequence to attain the best or most efficient operation with minimum human intervention.

An example of decision-making is

to decide which loading point needs the next train of empty cars presently leaving the dumping area.

Justifying Automation

Automation is not justified unless it can pay its way. To attain eco-

nomical operation of a mine, one of the purposes of automation may be increased manpower efficiency. The result of increasing manpower efficiency may be an increase in the number of tons produced per person so that the mine output increases. Beyond this there are many other potential benefits of automation in industry that are more apt to justify automation than the increase in man power efficiency. Some of these are:

 Increased utilization of equipment resulting in more production without additional capital investment.

2. Higher product quality in that the operation is more consistently monitored and necessary adjustments in operation are determined and corrected more quickly.

3. Increased flexibility resulting in faster response to the superintendent's instructions in changing the pattern of operation.

4. Reduced abuse of equipment because it is operated consistently within its rating resulting in reduced maintenance co.t.

Thus the effect of automation on the workman's job is normally apt to take away the drudgery and routine and leave him with a challenging job of making the whole operation function better rather than just making sure that it operates. Automation will undoubtedly improve the personnel safety in many areas of the mine operation.

The Computer's Task in Automation

Since the large automation tasks are performed by computers or by computers' little brothers which are called program controls, it will be well to examine at this point, "what can a computer do?" Basically a computer is a control machine that can perform several functions. It collects information on what is going on at a very high rate of speed. It stores a knowledge of the process with which it can then perform either arithmetic or logic based on the basis of stored rules. Since the nature of arithmetic is well understood, let's take a look at logic and do it in terms of an experience common to all of us, starting the day each morning. The accompanying flow diagram demonstrates the system of logic that one might have stored in his mind to use for this routine function (see Fig. 1).

Dispatching Commands in the Mine

If we were to apply this type of logic flow diagram to the haulage operation, we would need to go through the same type of thinking process that is presently used by the dispatcher. The control system would make very clear decisions and perform well-defined mathetical calculations in places where the operator presently makes his decisions based on experience but tempered with intuition and emotion. This means that the control system will be much more accurate and consistent in its method of operating. The logic of this flow diagram must be specially designed for each case based on local operating conditions and objectives. A simple example would involve:

- 1. Initializing function, Fig. 2.
- 2. Loading-point monitoring function, Fig. 3.
- 3. Route selection function, Fig. 4

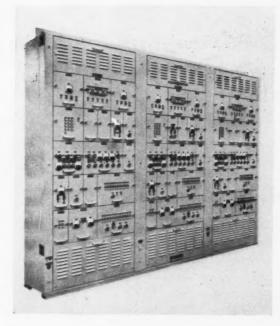
Obviously before such a dispatching system was used it would be necessary to do a far more detailed job of defining the type of thinking that the operator presently performs. In addition, some changes will be desirable in the decision making process because the control is able to think and act faster, has more complete information, and is more consistent in its operaton than the operator.

It may be desirable to make the operation of the logic more elegant than we have outlined here. For example, the calculations of car loading time may be recalibrated on the basis of the number of feeders in operation, or even on the basis of measured flow down the conveyor belts. The more flow, the shorter the loading time. Also, the time of traverse between trip and dumper may be varied, based on the number of loaded cars being hauled. This type of adaptive modification must be evaluated in the individual case based on cost vs. benefits.

Train Running

Once the train is on its way, the control system assumes the responsi-

FIG. 10 - PRO-GRAM CONTROL PANEL.



bility of keeping track of its location, along with that of every other vehicle in the mine. Such vehicles as material cars, foreman's jeeps, and maintenance vehicles, although not under the control of the system, must be tracked so that the system can order them into sidetracks or even stop the haulage to avoid collisions.

With a knowledge of the location of all haulage trains and other mine conditions, the system will also set the speed of the trains, position of track switches, setting of derail switches on grades, and the use of warning signals.

The control aboard the locomotive, having received speed commands, will control train direction, train acceleration, braking torque, train stop position, wheel sanding, warning signals, etc. Undoubtedly some functions may remain under operator control. Examples are as follows:

- Collection and distribution of cars at the loading point by the operator on the swing motor.
- Car pole switching at the terminal points by the swing motor operator.
- 3. Detection of a roof fall by the fire inspector.
- 4. Dragging equipment detection by the dispatcher, aided by closedcircuit television.

The Automatic Haulage System

The operation of loading and dumping the cars is a fairly straight forward sequencing and interlocking function which is in operation in a number of mines and has been described in technical papers in the past.

When we put together automation systems for each of these functional areas, we believe they comprise a very feasible automation system for underground haulage. Let me hasten to add that to our knowledge the complete job has never been done. If we were to undertake it in a specific mine, we would find that there are some major limitations. However, proper teamwork among the mine operator, the mechanical supplier, and the electrical supplier should make the job possible.

Related Automation Experience

At this point we would like to give you some examples of automation systems which contain some of the same elements as this minehaulage job.

Blast furnace skip hoists are now being loaded with a measured amount of material from conveyor

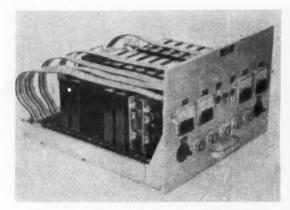


FIG. 11-ONE DRAWER from a control panel.

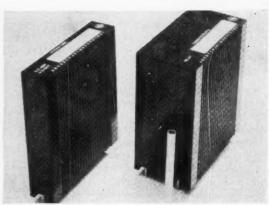


FIG. 12-CONTROL MODULES.

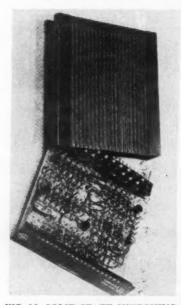


FIG. 13-SOLID STATE SWITCHING MODULE.

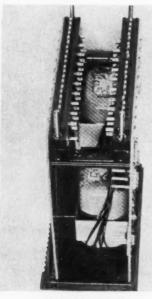


FIG. 14-RELAY MODULE.

mixing systems. Fig. 5 shows this type of blast furnace control which embodies the control needed for conveyor loading of mine cars.

Fig. 6 shows a distribution warehouse in which there are 72 types of products being tracked from individual storage areas, counted out, and grouped into retailers orders. The control had the same job to do as though it were keeping track of and directing cars in the mine.

Several sinter plants have been provided with regulating control systems to work with weigh scales, X-ray analysis gages, and other sensors. The control shown in Fig. 7 performs the classifying and blending of materials similar to a coal-preparation plant.

The program control in Fig. 8 is for a structural mill. In a single installation this type of control coordinates the timed sequence and regulated adjustment of literally hundreds of motors.

A process control computer is being placed in control of a hotstrip mill to perform the on-line decision making required to optimize the settings of the programmers and regulators as shown in Fig. 9.

Product Design Considerations

The subject is not complete until we look briefly at the type of equipment used to perform these control

functions. Fig. 10 shows a programcontrol panel providing both regulating and sequencing functions. This panel is divided into individual drawers, each containing a discrete function such as a code converter, counter regulator, power supply, or test equipment. An individual drawer out of this panel is shown in Fig. 11. Notice particularly the testing tap switches and meters on the face of the drawer, designed to pinpoint the location of any problems. Note also the "black box" modules inside the drawer, each of which are individually removable by simply unplugging. Thus the maintenance man can simply locate and replace any faulty unit in a minimum of time working from factory provided test instructions.

The two sizes of modules, called Directo-Matic units, are shown in Fig. 12 next to a cigarette to get relative size. In a given installation involving thousands of such units there may be fewer than 20 varieties, minimizing spare parts problems. Any units that are replaced can be repaired by the user or returned to the factory for credit against new units. Inside these black boxes may be solid state switching or amplifying circuits (Fig. 13) or hermetically sealed relays (Fig. 14). All are mounted in a common design for any kind of control system work.

The techniques and the hardware to perform automation functions are available now. Most of the examples discussed here have from one to three years of service in industrial usage. We think that practical, reliable automation systems are possible in the mine today.



Why Yieldable Arches are so effective in control of spalling roofs



In a large coal mine in West Virginia, the immediate roof is bone coal, slate, sandstone, sandy shale, and other materials difficult to control. During mining operations these overlying strata often broke off and fell into the workings.

Bethlehem's Yieldable Arch provided the most dependable and economical answer, because it was designed to "give" under extreme pressures and impacts. Lagging and packing around the Arches catch

the falls as they occur, and transfer the load to the steel arch sets. The Arches yield a little at a time as pressure builds up, thus allowing the roof to arch over and stabilize itself.

A Yieldable Arch set consists of U-shaped segments which are heavily flanged to resist torsional stresses. The segments lap each other at the ends, where they are secured with pairs of husky U-bolt clamps to provide a friction joint.

When loads overcome the friction the Arch yields gradually to relieve the pressure, at the same time giving the overburden a chance to establish equilibrium

Many mines have discovered that Yieldable Arch installations pay for themselves in a matter of months. A Bethlehem engineer will welcome the chance to discuss with you the advantages of Yieldable Arches in your mine.

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Coal's New Horizons Surveyed at SRI Conference

The future energy market and coal's share in it.

Developments in the coal-burning gas-turbine field, railway electrification, liquid fuels, high-Btu gas and chemicals.

Transportation, research and coal's part in national progress.

"THE UNITED STATES NEEDS a vigorous, thriving coal industry to meet its expanding energy needs." This sentence in the welcoming statement by Thomas W. Martin, chairman of the Board of the Alabama Power Co. and also of the institute itself, set out the goal of the conference on "Coal's New Horizons," staged by the Southern Research Institute at the Dinkler-Tutwiler Hotel, Birmingham, Ala., Oct. 3-4. Fourteen speakers directed themselves to developing the basic theme, as follows:

Coal's New Horizons, Raymond E. Salvati, chairman of the Board, Island Creek Coal Co., Huntington, W. Va.

Truly, as we meet today, the coal industry is emerging from a period of constant turmoil and uncertainties into a period in which we can at least see some degree of stability and improvement, but the experience gained over the past few years and the outlook for the immediate future do not, in themselves, provide us with the full insight to explore the new horizons for coal. . . . If coal is again to enjoy its place in the American economy and again be recognized as America's basic natural resource, we, as a group, must profit from our mistakes of the past, which I think can be summarized in one word -shortsightedness."

Complacency has been perhaps the greatest fault of the past—in marketing approach in dealings with the public, the United Mine Workers, the railroads,

the equipment manufacturers and state and federal governments. "As we view coal's new horizons we cannot and must not be complacent as to the powers and influences now working against our interest." Coal's competitors have seized on this complacency in all directions at the expense of coal. "Nor can we, in my opinion, discuss the future without acknowledging the fact that our accomplishments over the past 10 yr were strictly defensive and solely in the interest of survival."

Lack of cooperation with each other and with the organizations representing coal has been one of the coal handicaps of the past. "At long last, however, coal and its allied industries recognize the error of their ways and through an acknowledgment of importance to each other, are prepared to fight for and enjoy the benefits of progress which can be attained only through a united effort. No longer is the industry or its associates guilty of complacency. No longer are we guilty of taking things for granted. . . .

"In short, coal and its allies are now better equipped and organized than

INDUSTRY MEETING— A Special COAL AGE Staff-Written Report ever before to meet the challenge of the future. The question is, 'Will they succeed?' In my opinion, the answer is 'Yes.' But—it will not be easy." But all involved must do their part in supporting their organizations. If all concerned do the job they should do, "I am confident that . . . we have the potential to re-establish coal as one of the strongest, most-progressive and most-dependable segments of our economy, and having done so we can, with full conviction and without hesitation, plan for and expect unlimited horizons for the future."

Coal Supply and Demand in the Nation's Expanding Market, T. Reed Scallon, chief, Div. of Bituminous Coal, U. S. Bureau of Mines, Washington, D. C.

On the basis of present knowledge, it seems reasonable to project coal demand in 1975 at 671 million tons. This assumes that no major technological breakthroughs will occur, that trends in production and consumption efficiency for each energy source will continue, current price spreads among fuels will remain the same, projected national economic developments of energy-consuming industries are used, present trends in foreign use patterns of fuels will continue, and there is no change in international policy or relationships.

With these assumptions, the 1975 projected demand breaks down as follows (millions of net tons):

Electric-power generation	440
Coke	90
Manufacturing and mining:	
Cement mills	11
Steel and rolling mills	8
Other mfg. and mining	70
Retail deliveries	20
Motive power	2
Exports	30
1975 total	671

Will coal be able to meet this de-

mand? "If foreign supplies of energy should for any reason become completely unavailable to the U. S., our vast coal reserves, together with our indigenous energy sources, would assure us sufficient energy supplies to defend and advance our democratic freedoms and our standard of living. Indeed, our coal reserves alone, if necessary, could provide such assurance. They could even provide us with oil and gas. The Nation's recoverable reserves of coal, at only a 50% rate of recovery, could support current production for more than 2,000 yr."

"Liquid Fuels From Coal," Wilburn C. Schroeder, professor of chemical engineering, University of Maryland.

If coal can come up with a successful method of conversion to liquid fuels it would mean a reversal of the trend against coal and result in enormous increase in tonnage. For the country it would mean a shift from a limited source to one that could support demand for centuries.

After World War II it appeared as if U. S. oil was in for an era of unlimited growth. But now the U.S. is importing even though it has major excess producing capacity. One reason is rising cost of the U.S. crude which, among other things, is causing refiners to go abroad for lower-cost supplies. Abroad, England and Europe have also turned to oil and, like the U.S. have turned to areas over which they have no control for their supplies. Is this a safe procedure? What would happen to the U.S. and Free World energy supply if the source countries for political reasons decided to chop off shipments?

These and other factors are involved in the question of whether synthetic liquid fuels will play any part in U. S. and Free World energy setups. But it perhaps can be accepted that the U. S. needs synthetic plants to stabilize prices to the U. S. if for no other reason. Ability to produce our own oil synthetically would mean control of world oil conditions.

A synthetic industry also should be competitive, which means in both capital and operating costs. The cost for hydrogenation plants is about the same as petroleum plants, or \$8,000 to \$9,000 per bbl-day. However, cost of petroleum plants abroad is around \$3,000 per bbl-day. Operating cost of synthetic plants would be close to today's gasoline prices, or 10 to 12c per gal.

Fisher-Tropsch is another possible process, but requires much more work. There are large reserves of oil shale. Plant costs are not high, but operating costs are. Tar sands, another possibility,

TABLE I—Total Energy Consumption in The United States for Selected Years

(Millions of Tons of Bituminous Coal Equivalent)

	Total Energy			Petrol- eum							
1960	1,714	397	23.2	711	41.5	539	31.4	67	3.9	-	-
1975	2,750	900	32.7	1,055	38.4	665	24.2	80	2.9	50	1.8
2000	4,000	1,200	30.0	1.238	31.0	615	15.4	92	2.3	855	21.3

also are subject to additional development.

"Potentialities, Problems and Possible Solutions to the Coal-Burning Gas-Turbine Development," Glenn B. Warren, consulting engineer, Schenectady, N. Y.

"With respect to the coal-burning gas turbine, it seems that the four mostinteresting applications are:

"1. As a railroad-locomotive power plant.

"2. As a part of a coal-burning combined gas-turbine, steam or vapor power plant for large-scale electric power generation.

"3. As an externally-fired closed-cycle gas turbine.

"4. As a means of using more directly the heat of coal without removing it from the ground."

Probable high cost and uneconomical application of the complete locomotive have been major problems in the locomotive field. These also have been involved in attempts to use a pressurized gas producer ahead of the turbine.

Exhaust-fired and supercharged boiler cycles are available in setups combining gas and steam turbines, but a great deal yet remains to be done. A possible alternative approach is to reduce the speed of the turbine and increase the number of stages, greatly reducing ash erosion and permitting improvements in the design of certain elements.

The closed-cycle coal-burning gas turbine has certain advantages but offers no increase in efficiency and presents problems of heat transfer. Also, it is not easily portable or quickly started.

"If it becomes feasible to gasify or otherwise burn coal underground and in place in new mining developments or in connection with recovery of coal left in old mining operations, it will probably require large quantities of compressed air." This the turbine is inherently qualified to provide. "This may be an important development."

The Future of Coal Chemicals, Fletcher L. Byron, president, Koppers Co., Inc., Pittsburgh. "The coal-tar industry was essential to the early growth of the dye and synthetic-chemical industry," but at the first real shortage of an "indispensable" coal-tar raw material man learned to make it from other things.

World War I found the coal-tar industry essential because it provided chemicals for military explosives. Greatly needed chemicals for aviation fuel, synthetic rubber and other special military needs were contributed in World War II, which "saw a period of great shortages of coal-tar products and the introduction of processes and equipment by which these chemicals could alternatively be produced by the petroleum industry.

"We turn to a future in which the coal-tar industry will still be important, both in peace and times of military emergency. It will be an industry which is no longer our only source of supply, but it still will be important as a source of needed chemicals and one which may remain indispensable as a source of certain bulk materials, namely pitches, for a long time to come . . .

"The coal-chemicals industry must conduct research intensively in well-defined areas because it must never make the mistake of being complacent and underestimating its competition. We look forward to an industry in which ingenuity will be needed to a high degree. With aggressiveness and ingenuity, we look to a future in which the coal-chemicals industry will remain strong and prosperous."

The Prospects for Railway Electrification, John W. Barriger, president, Pittsburgh & Lake Erie R. R., Pittsburgh.

"The economic and technical problems involved in providing continuous electrical connections between stationary sources of electrical power and moving locomotives (including multipleunit cars) have heretofore prevented the widespread electrification of railways to the extent originally forseen. Has the time now arrived for a new look at the potentials of railway electrification?

"Within 20 yr after its development the diesel completely ousted the steam locomotive, thereby eliminating coal as a fuel for railway operation. This pro-

TABLE II—Electric Utility Generation and Fuel Consumption for Selected Years

(Billions of Kwh and Millions of Tons Bituminous Coal Equivalent)

	Total		0	Coal		Petroleum		Gas		Hydro*		Nuclear	
		Coal		Coal		Coal		Coal		Coal		Coal	
	Kwh	Equiv.	Kwh	Equiv.	Kwh	Equiv.	Kwh	Equiv.	Kwh	Equiv.	Kwh	Equiv.	
1960	753	322	402	179	45	18	160	66	146	59	_		
1975	2,000	700	1,310	475	90	30	200	65	250	80	150	50	
2000	6,000	1,600	2,250	600	50	13	150	40	350	92	3,200	855	
*Public	utilities	general	tion on	ly.									

duced serious problems for the coal industry and adverse traffic reactions on railroads. The dependence of the railroads upon oil presents important questions relating to national defense and the conservation of a limited natural resource.

"I believe . . . that the technological progress already achieved in electrical engineering and reasonably in prospect should break down the long-standing barriers to railway electrification. We stand, in my opinion, near, if not already upon, the threshhold of another revolution in railroad motive power. I predict that over the next 25 yr all the major mainline railroad mileage of the U. S. will be electrified, with the diesel locomotive used only on the less heavily utilized tracks of secondary and branch lines, yards, sidings, etc. . . .

"My optimism is tempered by two assumptions: first, that the national transportation policy actually prevailing will permit the railroads to have the equality of competitive opportunity now lacking, and, second, that large-scale consolidations will be consummated. The first is necessary to enable the railroads to maintain their volume and lower their prices and the second is necessary to improve efficiency through concentration of traffic on the routes of superior characteristics."

High-Btu Gas From Coal, Martin A. Elliott, academic vice president, Illinois Institute of Technology, Chicago.

"One of coal's brightest new horizons is its use in producing high-Btu gas. When this horizon is reached in the not-too-distant future, coal will play an important role in supplementing our supplies of natural gas. In the very long-range future coal will supply the major portion of the gas demand and eventually will approach the position it held at the inception of the gas industry when coal was the only source of gas.

"In supporting these statements we must develop answers to such questions as: When will supplemental high-Btu gas be needed? How will high-Btu gas be produced from coal and what is the present status of this technology? What is the long-range competitive position of high-Btu gas as a source of energy? What is the very long-range potentiality for coal as a source of high-Btu gas? . . . In this connection it should be emphasized that we are considering a period considerably beyond the next decade or two for which normal gas-industry planning has provided an entirely adequate supply of natural gas."

When supplemental gas will be needed depends on the ultimate gas available for recovery, the demand and the deliverability. The time varies over a considerable span of years, but it would appear that supplemental gas might be necessary in some areas in the 1970s.

Methanation and hydrogasification are under development for the production of high-Btu gas from coal-and oil shale. Methanation would require 157.6 lb of coal per million Btu of gas produced-142.9 lb for process and 14.7 lb for power and steam. Hydrogasification would take 116.2 plus 23.9 or a total of 140.1 lb per million Btu of gas output. Per trillion cu ft of 1,000-Btu gas, some 70 to 80 million tons of coal would be required. "This quantity of gas is about 8 to 9% of the yearly natural-gas production in recent years. Cost estimates by a number of organizations indicates a gas cost by methanation of \$1 to \$1.25 per million Btu; by hydrogasification, \$0.75 to \$1.

"These costs are well above current natural-gas prices." Eventually, however, we will see "the transition from an energy system based primarily on fluid fossil fuels to one based primarily on solid fossil fuels which will be processed to yield fluid fuels. . . . In this transition coal will reach one of its new horizons and eventually will become a major supplier of energy."

The Challenge of Change, Stephen F. Dunn, president, National Coal Association, Washington, D. C.

"The coal industry has met the challenge remarkably in its production process . . . met it so effectively that the average price of coal at the mine was 30c a ton lower last year than in 1949. . . . While these changes

were occurring, the coal industry was challenged by the most fundamental and sweeping change of all-a drastic alteration in its markets."

The railroad market was lost and retail deliveries dropped drastically. But while this was going on, coal was enjoying greater and greater utility demand—a market it had to fight for, along with other markets, against short-sighted policies permitting gas sales and imports of residual oil at low rates. The use of coal by the utilities will continue to increase in the future while the steel industry is expected to continue to be the second largest user of coal. Other major industrial customers will maintain their demand.

"But what of the more immediate future? The coal industry believes that its minimum annual production, if it is to enjoy reasonable economic health and be capable of expanding sufficiently in national emergency, is not 415 million tons, but 500 million. Here is a challenge we have not yet completely met." To meet it, "we propose a program of research, marketing and public relations to achieve our goal of a 500-million-ton market."

The Primary Energy Sources in the Country's Energy Economy in the Next Four Decades, Philip Sporn, president, American Electric Power Service Corp., New York.

Concentration on the glamorous in fuels as in other things tends to obscure the fact that there is a great deal yet to be done in the development of the fossil fuels, and in fact that other developments must wait until the work is carried out with the fossil sources. There is need for better recognition of the position coal now occupies and its potentials for the future. Out of better understanding will come the proper allocation of efforts in the development of the various types of energy.

Even after 1975 it should be noted that the principal source of energy (see accompanying table) will continue to be the fossil fuels, while the major factor in coal's growth will be the continued increase in the production of electric power, where coal dominates and will strengthen its position. Nuclear competition will not be prominent for a decade or more, espically since conventional generation continues to become more economical, thus presenting a moving target.

AEP now visualizes highly efficient conventional plants at an investment cost of \$100 per kw, against today's figures of \$125 to \$150. Assuming a fixed-charge rate of 14%, costs of energy on the switchboard in 1970 break down into 2 mills for capital



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The photographs at the left illustrate just three examples of the many ways explosives energy is being used more fully, more efficiently. On a section of the Turkey Creek Expressway near Kansas City, the objective was maximum breakage and production on every shot. For this contractor, efficient use of explosives energy meant more thorough and consistent breakage, more payload work out of each piece of his equipment, and minimum downtime from end to end of the job.

In another case, a coal stripper in Ohio developed a way to eliminate almost one-half the total mechanical handling of overburden. He used explosives force to cast much of the overburden directly to the spoil pile, thus eliminating almost half of the mechanical handling previously required.

A quarry operator in Maryland boosted his production and lowered his maintenance downtime by using explosives energy to get more thorough, uniform breakage and excellent displacement for easy digging. The result was better production by both the shovel and the crusher-with reduced maintenance costs as a bonus.

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Hook-Twin Tie Plates are available in several lengths. They are low in cost, yet they offer a healthy return in safety and trouble-free operation. A Bethlehem mine-track engineer will be glad to go over the full story with you. You can reach him through the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY, Bethlehem, Pa. Export Sales: Bethlehem Steel Export Corporation



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cost, 0.25 mills for operation and maintenance, and 1.65 mills for coal at heat rate of 8,250 Btu. The total is 3.9 mills, against the nuclear target of 7 mills in 1970.

Coal's problem will be that of continuing to provide increasing quantities at reasonable cost. This means that coal must continue to press for both a low mining cost and a low delivery cost. It is vitally important also that the indispensability of coal and the other fossil fuels be recognized and their importance brought to the attention of the people and of government. Emphasis on this will contribute significantly to realizing "that very bright future" ahead for the industry.

Increased Productivity Through Technology, W. L. Wearly, president, Joy Mfg. Co., Pittsburgh. (Presented in full elsewhere in this issue—p. 56.)

New Developments in Transportation, S. L. Jewell, vice president, Peabody Coal Co., St. Louis.

"Because coal men have increased productivity by heavy investments in mechanization, the average price of coal at the mine last year was 30c a ton less than in 1948. However, transportation costs are largely outside our power to control. . . . The average freight bill on a ton of coal rose from \$2.74 in 1948 to \$3.40 in 1960—a rise generally reflected in the cost of coal to the consumer. . . .

"Coal producers have not reached the end of the line in boosting efficiency, but the fight to keep coal competitive must turn also toward economics in transportation. Coal men need help in this fight—help from customers, carriers and rate-making agencies. Fortunately we are beginning to get it."

Improvements in the transportation picture include competitive rail rates, better car equipment (including special integrated trains) and better traffic control. Barge movement offers increasing possibilities of economy, and better facilities for handling coal at loading and unloading points or ports are being provided. Truck movement of coal to market likewise is being improved. And in addition to these, movement by pipelines and as high-voltage electricity could grow in the days ahead.

"We hear a lot about 'high-fuel-cost areas' which are virtually closed to coal. This is a misnomer. These are really high transportation cost areas. Improved transportation methods can and will bring them low-cost coal—the world's best and cheapest source of light and power. . . .

"This situation gives us an outlook that is distinctly encouraging to coal men. Through mechanization and increased productivity they have made considerable progress in stabilizing coal costs. They are committed to a program of continuing this drive to still-lower mining costs. They believe now that the next decade will see transportation people pursue the goal of lower costs with the best methods of modern research and with all the determination at their command. The resulting combination of low-cost-coal and low-cost transportation promises to enable coal to realize its fullest potential as one of the Nation's basic industries."

Lignite's Future Role, Wilson M. Laird, head, Dept. of Geology, University of North Dakota, Grand Forks, N. D.

The lignite deposits of the U. S., with North Dakota as the largest single state, constitute a major energy reserve that is yet largely untapped. Its use requires consideration of its characteristics, which are less than 8,000 Btu (N. D.), about 37% moisture and difficulties in handling and storage because of slacking and spontaneous combustion. Research, however, has brought significant improvements in the latter. The high water content also has limited use to date at distant points.

For the future, carbonization or drying should make lignite more widely usable, with possible significant applications including complete gasification for synthesis or pipeline gas, hydrogenation of the lignite or products thereof for liquid fuels, such special-purpose uses as a source of wax, activated carbon, pigments and drilling-mud additive. A more-promising future possibility is reduction of iron either as a fuel or a reducing agent, either as lignite proper or as a char or gas. The best possibilities at present, however, are in fueling electric generating plants, and use of lignite for this purpose is expected to rise rapidly in the years up to 1980.

Coal: A Dynamic Force in the Future of Our Economy, Joseph E. Moody, president, National Coal Policy Conference, Inc., Washington, D. C.

"As we try to evaluate the future of fuel use, we cannot help but recognize that the signs point to coal's taking its proper position in relationship to other fuels. . . . With the tremendous reserves of coal we have in the U.S. and our ability to mine it efficiently and cheaply, and with the advances in technology that are constantly taking place, making the record of the last year and the last 5 yr obsolete, we can expect that coal will continue to produce most of our electricity, that it will produce a major part of our gas, that it will participate in the liquid-fuels market, and also that it can, without doubt, anticipate a major

market in the production of fissionable materials for the Nation's atomic programs."

A basic reason for this viewpoint is coal's newly-developed ability to work in concert with its own members-management and labor-and the representatives of allied industries-and even to find common ground with other energy industries. A major instrument in making this concerted effort effective is the National Coal Policy Conference, Inc. NCPC was the chief sponsor of "a sound study by a committee of Congress of all our national fuels and energy problems, leading toward the establishment of a coordinated National Fuels Policy," which study now has been authorized. NCPC "will devote its fullest energies to helping see that it accomplishes the great good for the Nation we feel it can and must."

"There is not the slightest doubt that, in the foreseeable future of energy demands and supply for the world we live in, coal must be a dynamic force."

Research Program of OCR, George A. Lamb, director, Office of Coal Research, Washington, D. C.

"During the past 3 yr bituminous production has stayed around 410 million tons. This figure is considerably below the 500 million the industry has stated it must produce to maintain its plant and equipment and meet an emergency demand. The need to raise anthracite output is clear.

"To assist in the development of a stronger coal market in the immediate years, the Congress created the Office of Coal Research." Its eventual success or failure "will be measured by its contribution to the development of expanded coal markets. . . . Thus, a vital function . . . is to aid in finding better and cheaper ways of mining and preparing coal, delivering it to the consumer at lower cost, and improving the efficiency of its utilization." It is concentrating its efforts on short-range projects aimed at providing the most immediate assistance to the coal industry.

"The Office of Coal Research will conduct no projects with its own staff." Instead, it will provide funds for research and development projects through contractual arrangements with universities and colleges, research organizations, mining and manufacturing firms, qualified and equipped individuals, and with other government agencies. When appropriate, OCR may also co-sponsor projects with other agencies or organizations. The aim is "to buy the greatest possible benefit to the national economy, to the coal industry and to the American taxpayer with every dollar spent."

Joint Solid-Fuels Conference Looks at Mining and Utilization

Preparation, computer mining analysis and maintenance balance utilization topics, including chemical coke from traveling-grate stokers and conversion of refuse into lightweight aggregate.

SPONSORED BY the Coal Div. of the Society of Mining Engineers, AIME, and the Fuels Div., ASME, with the cooperation of the Southeast and Birmingham sections of the respective societies, the 24th annual Joint Solid Fuels Conference was held at Birmingham, Ala., Oct. 5-7. Four technical sessions, plus banquet and luncheons, covered topics involved in the production and utilization of coal and collateral matters.

General chairman was James A. Hagy, manager, coal mines, Alabama Power Co., Birmingham. Toastmaster at the banquet was Dr. Milton H. Fies, consulting mining engineer, Birmingham. At the banquet, Julian E. Tobey, consulting engineer, Cincinnati, presented the Percy Nicholls award to Otto DeLorenzo, Combustion Engineer ing, Inc., now retired.

Coal men acting as session chairmen included P. L. Richards, U.S. Steel Corp.; James R. Jones, Peabody Coal Co.; J. Richard Lucas and C. H. Long, Virginia Polytechnic Institute; and W. S. Springer, Tennessee Coal, Iron & R. R. Div., U. S. Steel.

Preparation of Coal for the Metallurgical Market by Donegan No. 1 Cleaning Plant, J. L. McQuade, senior executive vice president, and Carl B. Taylor, preparation engineer, Maust Coal & Coke Corp., Richwood, W. Va.

Construction of the Donegan No. 1 cleaning plant of the Saxsewell Div. of Gauley Coal & Coke Co., in Nicholas County, West Virginia, had as its aim the preparation of a metallurgical coal with not over 2½% ash and 0.60% sulphur. "Our average to date is much better."

Stream pollution was a major consideration, which led to the use of a special pneumatic separator, the Dorrco Fluosolids Sizer, developed by Dorr-Oliver, to remove 48 x 0 from the feed to the Deister tables. Removed in such a fashion it is not wet, does not require drying, is kept out of the water and thus has no opportunity to cause stream

pollution. Working at the efficiency of 92%, the separator also does some cleaning since at that efficiency the separator does not tend to pick up pyritic sulphur or pure slate from the fluid bed.

Other major equipment includes a Chance cone, horizontal filters which cut table-coal moisture to 13½% with practically no degradation, and a Dorrco Fluosolids dryer.

The Preparation of Coal for the Electric-Utility Market, James F. Brown, manager of coal operations, Southern Electric Generating Co., Birmingham.

"The utility market is not a quality market. Btus are bought at the lowestpossible price. With fuel cost in a modern plant comprising approximately 48% of the total operating cost and 85% of the controllable cost there is a tremendous incentive to design steam plants to accommodate the lowest-price heat available." Modern plants will handle wide variations in coal quality. However, cost of downtime would tend to rule out coals with lower qualities. If the coal is good in the raw state and the plant is at the mine mounth, added cost of preparation may not be required. If the coal must be transported some distance, freight on inert matter becomes an important consideration.

"The two new mines of the Southern Electric Generating Co. are excellent examples of coal being tailor-made for the electric-utility market, producing 2,000,000 tons of coal per year." At Segco 1 coal is crushed underground to 4 in and placed in a stockpile. Plant capacity is 750 tph and equipment includes a jig and a drag tank for minus %. After screen dewatering the coal is shipped. Total crew is 5 men, and mine

INDUSTRY MEETING— A Special COAL AGE Staff-Written Report output is 1,500,000 tons per year. Equipment at Segco 2 includes scalping screen, crusher, raw-coal storage, Baum jig, two dewatering screens, settling cone, thickener and railroad-car hoist. The plant crew is 3 men. Production is 500,000 tons per year.

"The design of these two plants was dictated by sink-float analyses of the coal seams to be treated.... Dewatering of the coal is accomplished by drainage enroute to the plant. Holes have been drilled in the car bottoms to allow drainage. The railroad movement to the plant employs a minimum number of railroad cars. The coal loaded each day is dumped and the cars are returned to the mine for loading within 24 hr. Uniform daily loading is made possible by the raw-coal stockpile." This system provides the most advantageous freight rates.

Remaining Recoverable Coal Resources of a Part of the Southern Appalachian Field, R.Q. Shotts, professor of mining engineering, University of Alabama.

"This report is a review of recoverable reserves of bituminous in the Southern Appalachian area according to the latest possible estimates." The area comprises Alabama, Georgia and Tennessee and counties in eastern Kentucky and Virginia that TVA might draw coal from.

"The arbitrarily selected Southern Appalachian area considered has, according to the most-recent estimates, recoverable reserves of approximately 12,350 million tons in beds 28 in or more thick. About one-third is in beds 42 in or more thick. The average coal-production of the region for the period 1955-57 was almost 64 million tons. At that rate of production the reserves of the region should last almost 200 yr."

The Application of Digital Computers to Mining-Systems Analysis, Robert W. Bouman, development engineer, Youngstown Sheet & Tube Co., Youngstown, Ohio, and Robert L. Frantz, in charge, Mining Engineering Div., The Ohio State University, Columbus.

"It is believed that most mining systems now being used are not the most economical possible and that there are methods of evaluating the merits of a particular system. . . The purpose of the present investigation is to illustrate one method for evaluating one of the

variables in a mining system. The method will be to simulate the mining operation with the aid of a digital computer for the purpose of obtaining a cost comparison over a range of variables. The variable that will be considered is the center-line distance between entries and breakthroughs. . .

"Without the services of a high-speed digital computer this investigation, or at least this approach to the problem, would not be feasible. Furthermore the accuracy of the computer cannot be matched by the man and desk calculator. The actual computation with the computer does not require a great deal of time, but the programming and debugging procedures do. Once the program is working properly, many 'experiments' can be made merely by changing some or all of the data."

Controlled Stoker Operation Produces Coke, Steam or Both. L. J. Cohan, fuel burning equipment specialist, Combustion Engineering, Inc., Windsor, Conn.

"Producing chemical coke in areas where potential markets are available and at the same time generating steam for process use is economically feasible. Plants with existing traveling-grate stoker-fired steam generators can be used with a minimum modification to the existing equipment. . . The continuous coking process will produce a light, porous, reactive chemical coke. Based on coke containing 2% volatile matter and a loss of 7% fixed carbon, a yield of 1,100 to 1,200 lb of coke can be produced per ton of as-fired coal. The remainder is available as fuel gas for the production of steam."

Using Coal Refuse in Building Materials, J. W. Myers, chemical research engineer; J. J. Pfeiffer, supervisory chemical engineer; A. A. Orning, supervisory technologist (fuels), U. S. Bureau of Mines, Pittsburgh.

"Coal washery refuse from two different sources was studied in this investigation. Both materials can be converted into satisfactory aggregate for use in the manufacture of lightweight concrete blocks by burning on a chaingrate stoker." One refuse was from the Ceredo (W. Va.) plant of Truax-Traer and the work resulted in establishment of the Trulite Corp. (Coal Age, November, 1955, p 78) processing 120 tons of refuse per day. The other was from a Carbon Fuel plant, also in southern W. Va. Refuse should be crushed and pelleted for proper size distribution in the stoker feed. Predrying and preheating the pellets increases stoker-unit ca-

Selective Maintenance of Hydraulic Components of Modern Mining Equip-

ment, L. S. McNickle Jr., hydraulics engineer, Hanna Coal Co., Cadiz, Ohio

"Ireland mine of the Hanna Coal Co., which operates two production shifts and one maintenance shift per day, performs hydraulic maintenance on the midnight or maintenance shift. Production is thus allowed to continue without interruption from major hydraulic component malfunction. The plan is called 'selective maintenance', as we are selecting the specific part to be worked on and selecting the time the work is to be accomplished.

"Selective maintenance, as we perform it, is divided into six phases:"

 Scheduled component - parts checks-the key operation which establishes and maintains a complete record of all vital hydraulic component parts. The work is done by a skilled mechanic specialist.

2. Unscheduled component parts checks—a stopgap measure. The work involved is handled by the section mechanic or maintenance supervisor and includes repair, preventive maintenance and checking.

3. Component—part check—record evaluation. This involves comparison of data on check reports with previous life records and with standards, which promotes awareness of the signs indicating failure and facilitates scheduling of replacement and rebuilding before such failure.

 Component—parts changeout and circuit revision—the major sustaining phase of the maintenance plan.

5. Component—parts rebuilding and testing. This is an extremely critical and important phase, as any maintenance is never better than the replaced component parts.

6. Engineering. Selective maintenance aids and is aided by engineering.

"The current end results of the engineering studies, aided by selective maintenance, are good and the rewards great. We are now experiencing a pump-life pattern that allows us to 9 mo attainable under ideal conditions. We are no longer plagued by unexpected pump failures on a production shift. The advance of testing and evaluating methods removes the instances where a pump is replaced only to find eventually that a control valve, relief valve, cylinder or torque motor was the real item at fault."

Electrofrac Techniques, Erich Sarapuu, manager of research, Kewanee Oil Co., Fairfax, Okla.; R. L. Calhoun, vice president, and John W. Clarke, electrical engineer, Electrofrac Corp., Kansas City.

"Electrofrac techniques, in essence, consist of a portfolio of experimental findings stretching over the period since 1942. This experimental work was directed toward development of improved means of recovering energy or chemical constituents from shale, coal or petroleum reserves. Specifically, these techniques evolve around the use of electrical power for in situ carbonization and gasification in these hydrocarbon reserves. . .

"The net result of the extensive field work in coal seams is something greater than mere reconfirming and demonstrating the earlier laboratory findings; it enabled an appreciation of the operational variables under actual production conditions. At this time was started the long-continued effort to refine these operational variables into a practical state of economic usefulness."

Coal-Power for America's Progress, Joseph E. Moody, president, National Coal Policy Conference, Inc., Washington, D. C.

"There can be no doubt that in any critical emergency the Nation will have to look once more to coal to supply the vastly increased amounts of fuel that such an emergency would create . . . We know there is every reasonable expectation that a large amount of oil of all kinds which is now being imported will not be available. If our World War II experience taught us anything, it is that we can expect that domestic oil production will have to be diverted from industrial and civilian uses to direct military pipelines. This leaves coal as the only available source of significant amounts of additional fuel.

"The people in government and those of us in the coal industry know that without greatly increased coal production the Nation's war effort would have been seriously impeded in the last two world wars. We know further that unless large amounts of extra coal can be quickly made available, the Nation's security posture will be seriously compromised in any future emergency.

"Thus the question is not whether coal will again play a vital role in any future emergency. Rather the question is whether the government is adopting the type of policies that are absolutely essential if the coal industry is going to be able to meet fully its obligation to the Nation." Among other things, "it is time the government reversed its present policies and substituted for them a policy which recognizes the danger to the national security inherent in excessive imports of competing fuels. The time has come when the government must take steps to insure that the productive capacity of the coal industry is built to a reasonably safe level for security."



BRANCH AWARD was won by the Johnstown group for the second straight year. A. E. Molenski (left), Bethlehem Mines Corp., accepted award presented by W. E. Keally.



MAINTENANCE IDEA AWARD went to the general shop staff, Jones & Laughlin Steel Corp., Fredericktown, Pa. Howard Davies presented award to Paul Killuis (right).

ME-MMA's Maintenance Idea of the Year Award

Co.; Mike Yonko, manager, North American Coal Corp., system, according to the report. Powhatan Div.; and George May, division superintendent, Bethlehem Mines Corp.

Winner of this year's Maintenance Idea was shared by the general shop crew, Jones & Laughlin Steel Corp. Their idea eliminates the use of a hydraulic- or electric-motor drive for the vacuum pumps of the thru-steel dust-collector system. A mechanical drive was designed and developed for use on Joy ICM miners. The dust-collector system, as purchased, proposed that the vacuum pumps be hydraulically driven. This would overload the hydraulic system to a point that would hinder other operations and add considerable heat to the system. The other alternative was the addition of an electric motor to drive the pumps. The latter would have envolved permissibility changes and would have required considerable control apparatus. By properly mounting the two necessary vacuum pumps, it was found that they could be driven by V-belts 10SC shuttle cars.

A NEAR RECORD of 33 Maintenance Ideas were sub- from the same motor that is used to drive the hydraulic mitted to the selection committee. The three-man com- pump for the drills. The system has proven maintenance mittee included Al Hood, superintendent, Duquesne Light free and performs as well or better than the proposed

Runners-up are as follows:

Ohio Valley Branch-Albert Polivka, mechanic, Hanna Coal Co., Bellaire, Ohio-Improvement of 966 Goodman loading-machine tramming clutch.

Indiana Branch-Howard Fyock, chief electrician, Imperial Keystone Coal Co., Clymer, Pa.-Addition of angle guards on chainway of Lee Norse CM28 miner.

Allegheny Valley Branch-John Leskovich, mechanicrepairman, Republic Steel Co., Russellton, Pa. - Shop

Johnstown Branch-Don Lambing, chief electrician, Mine 31, Bethlehem Mines Corp., Nanty Glo, Pa. - Improved braking on locomotive using screw-type brakes.

Greene County Branch-Outside shop force, Buckeye Coal Co., Nemacolin, Pa.—Support for tram motors on Joy

Mining Electro-Mechanical Maintenance Association Probes ...

New Frontiers in Mining

AUTOMATION of underground rail-haulage systems, remotely-controlled miner and methane detection equipment were the subjects discussed at ME-MMA's ninth annual technical meeting held at the Mountain View Hotel, Greensburg, Pa., Sept. 30. The one-day meeting-ME-MMA's 13th anniversary-was attended by more than 300 members, patron members and guests.

A. V. Sypneski, first vice president of ME-MMA and maintenance engineer, Rochester & Pittsburgh Coal Co., Indiana, Pa., presided at the technical session. H. J. Young, ME-MMA president, and manager, Cooke Wilson Electric Supply Co., Ebensburg, Pa., delivered the welcoming address. Maintenance Idea of the Year awards were presented by Howard Davies, second vice president. Branch Award was made by W. E. Keally, third vice president. Toastmaster for the annual banquet was Robert Laing, executive secretary, Central Pennsylvania Coal Producers Association. Guest speaker was Dr. Carl C. Byers, General Motors Corp.

Following are abstracts of the technical papers:



"Automation"—Its Application to Underground Rail-Haulage Systems,

R. L. HOULTON, manager, engineering of automated systems, General Electric Co., Roanoke, Va.

The average person's concept of automation encompasses the replacing of people with machines. Actually automation is a word that can be all things to all people. We think of it in terms of four functions;

- 1. Mechanization by which a machine is modified so that it can be automatically adjusted for changing conditions, or machinery is added so that material can be conveyed from one place to another.
- 2. Feedback regulators which are added to measure the work being done, compare the results to a standard reference, and automatically make adjustments to assure desired operation.
- 3. Interlocking and sequencing which are used to cause operations to be performed in a prescribed order or to check the operation to make sure that limits are not exceeded that would damage equipment or material.
- 4. Decision-making which is applied to monitor the operation in process and change the set points on the regulators, or the order of prescribed sequence to attain the best or most efficient operation of the process with minimum human intervention.

Automation is not justified unless it can pay its way. There are many potential benefits of automation in industry that are more apt to justify automation than the increase in man power efficiency. Some of these are:

- Increased utilization of equipment.
- 2. Higher product quality.
- 3. Increased flexibility.
- 4. Reduced abuse of equipment.

If a logic flow diagram was applied to a haulage operation it would need to go through the same type of thinking process that is presently used by a dispatcher. The control system would make very clear decisions and perform well-defined mathematical calculations in places where the operator presently makes his decisions based on experience but tempered with intuition and emotion. This means that the control system will be much more accurate and consistent in its method of operating

The techniques and hardware to perform automation functions for an underground rail-haulage system are available. Practical, reliable automation systems are possible in the mine today.



Methane Detection Equipment,

W. P. PLACE, president, Femco, Inc., Irwin, Pa.

"As fully automatic machines come into use it will be necessary that action as well as alarm become automatic. This action may be automatic shut-off of power at the machine, at the point from which power is supplied to the machine, at the power source for a whole area or all three in succession."

A variety of instruments for the

more precise measurement of methane concentration are available. However, the value of these instruments, like the safety lamp, is based on the assumption that there will be a man on hand to operate the device, observe its indications and take any action that may be required.

Until very recently this assumption has been entirely sound, but now new advances in mining methods tend to change this assumption. The key element in this advance of mining methods is the unattended or remotely controlled machine which can also be expected to remove coal more rapidly and thus release more methane in a given period. This requires a fresh approach to the problem of methane detection.

Any system which will satisfactorily solve this problem must meet four major requirements:

- 1. It must be rugged enough to be mounted on a machine so that it will always be in the area of greatest methane concentrations.
 - 2. Detection must be continuous.
- The system must be highly reliable.
- It must transmit an audible and/or visual alarm to the nearest point at which a man is working.



The Pushbutton Miner,

K. E. McELHATTAN, product manager, miners and loaders, Joy Mfg. Co., Pittsburgh, Pa.

Complex programming and material handling techniques have been applied to coal mining. The Pushbutton Mining system coordinates

EXIDE POWER PACKAGE— THE BIG, NEW ECONOMIZER



Low-cost battery power

For any mine locomotive, there is one particular type and size battery that best meets your requirements. And only Exide offers so broad a range of types and sizes. Let your Exide man

recommend the one battery that's best for you. The Exide line includes Exide-Ironclad, with new higher capacity and longer life potential; Exide-Powerclad, premium quality flat plate battery; and Exide nickeliron-alkaline, invented by Thomas A. Edison.

High-efficiency chargers

Install high-efficiency Exide chargers with your batteries and save money on your power. Buy your chargers as part of an Exide power package. Your Exide man will recommend the size and type charger that fits your needs exactly. So you get



complete charging and don't pay for unneeded capacity. Correct charging rate helps prolong the life of your batteries. Choice of either rotating or rectifier type chargers.

3

Fast, dependable service

The complete Exide power package is the lowest-cost way of getting the maximum for your battery dollar investment. Exide service men, factory-trained specialists in Exide equipment, will help you attain lowest cost through long service life. Over 200 specialists located from coast to coast available to give you prompt service when you need it.

For complete information on the economies of the Exide power package, write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



INDUSTRIAL MARKETING DIVISION
The Electric Storage Battery Company



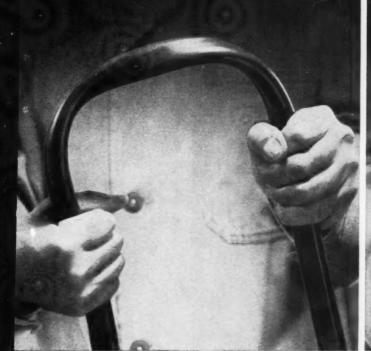
all aspects of transportation, punch mining, roof support, power supply, etc. The first unit has been designed to work along a highwall left after a stripping operation. Highwalls are up to 125 ft high. In general the miner mines coal that is under too much overburden for present strip mining machines. This completely mobile mining system can bore a hole 3 to 4 ft high and 9 ft 9 in wide up to a depth of 1,000 ft at a rate of up to 6 ft per minute. Approximately 11/2 tons of coal are mined per lineal foot of advance. Conservatively, this machine will average over 3,000 tpd on a three-shift operation. The unit can retract fast. Less than 30 min after the conveyors and boring machine are retracted onto a Heli-Track, the complete unit can be moved and the boring machines launched into a new hole.

The first machine is located at Conesville, Ohio. Peabody Coal Co. operates this mine to provide coal for an electric generating station. Coal produced at the mine site is transported by off-the-highway 60-ton trucks. Recent production tonnages have been in excess of 1,100 tons per 8 hr shift with three men.

The miner consists of three basic parts; the boring machine, conveyor train and conveyor storage mechanism called the Heli-Track. The boring machine and conveying line are an integral unit moving in synchronism forward and reverse as coal is mined or when retreating from a mined-out area. As coal moves from the boring machine to the outside of the hole, it is relayed from conveyor to conveyor until it is discharged onto an auxiliary conveyor at the machine launching platform.

To mine coal the operator directs the boring machine into the coal face by hydraulically adjusting the launching platform on which the boring machine rests. After the boring machine is properly directed, the operator may completely control the mining process from his position and advance the machine into the coal seam by controlling all operations remotely. As soon as the hole has been mined to its extremity, the machine is retracted and stored on the Heli-Track structure which is self-propelled. The Heli-Track then moves down the highwall approximately 12 ft to start the next hole. A rib thickness between holes of 2 to 4 ft is usually maintained.

RIMP



FLOP



NO STOP

HOW ROME MINING MACHINE CABLE PROTECTS AGAINST BREAKDOWNS

The cables on your shuttle cars and other equipment go through more contortions in one working shift than a tag-team wrestling match.

They flip. They flop. They twist. They flex. No holds barred.

This can mean breakdowns—more than you can afford. With ordinary shuttle car cables, "wrong-way" bends often cause the conductors to slip. This distorts the cable; one side may stretch, the other crimp. Perfect invitation to breakdown.

This can't happen when you use Rome 60 Parallel Duplex mining machine cable.

Try to bend Rome shuttle car cable the wrong way.

You can't. It just flips over and bends on its minor axis. That's because conductors and jacket are locked together to prevent damaging "wrong-way" bends.

That's just one way you'll move more coal at less

cost with this cable. You'll also benefit from the relatively small diameter, easy-handling flexibility, and high resistance to impact, rotting, deterioration, moisture and physical abuse.

Rome Cable Division of Alcoa, Dept. 15-111, Rome, New York.

Neoprene jacket forms resilient web between power conductors and ground. Result: web and jacket are an integrated unit which binds entire cable securely together providing high impact resistance and protection against shorts while maintaining maximum flexibility.





FIRST IN FIRST AID: COMPASS NO. 1—Kneeling, left to right, Manuel Cabe, Audrey Collins, Ernest Collins and Carl Frideley. Standing, left to right, are George H. Deike, Mine Safety Appliances Co.; Peter Mattaliano, superintendent, Compass No. 1; Jack Light, safety director; Leonard Timms, director, W. Va. Dept. of Mines; Shirley Summers, of Central West Virginia Coal Mining Institute's queen contest; Rex Lauck, UMWA Journal; Team Captain Dale See; Barbara Ann Liptak, "Miss Coal Mine Safety—1961;" Calvin Hiller; L. Clyde Riley and Eli Zivkovitch, UMWA; M. J. Ankeny, director, USBM; Leonard Pnakovitch, Albert Pass and Mike Gretchen, UMWA.

Compass, Inland Steel, Island Creek Win National Safety Honors

WINNERS in the 1961 National First-Aid and Mine Rescue Contest at Charleston, W. Va., Oct. 2-4, the nineteenth renewal of the contest, were:

First-Aid — Compass No. 1 mine, Clinchfield Coal Corp., Clarksburg, W. Va., Dale See, captain, repeating their 1959 victory as first-aid champions of the nation. The Compass team won the Congressional Medallion (donor, U. S. Bureau of Mines) and trophy (United Mine Workers of America).

Mine Rescue – Inland Steel Co., Wheelwright, Ky., Harrison Sparks, captain. Winners of Congressional Medallion (USBM) and trophy (Mine Safety Appliances Co.).

First-Aid and Mine Rescue — Island Creek Coal Co., Holden Division combination team, James Adkins, captain; Congressional Medallion (USBM) and trophy (National Coal Association).

Competing in the first-aid eliminations were 46 teams from the various mining states; 12 teams vied for honors in mine-rescue competition. Five combination teams participated in both events.

The contest was sponsored by the Bureau of Mines and the Joseph A. Holmes Safety Association in cooperation with state mine inspection agencies, management and labor of the mineral extractive industries and other safety-minded groups. General chairman was M. J. Ankeny, director, U. S. Bureau of Mines, and general vice chairman was Harry Gandy Jr., director of safety, National Coal Association,



FIRST IN MINE RESCUE: INLAND STEEL CO.-Kneel- INTERNATIONAL HARVESTER, second in mine rescue



ing, Charles Rollins (left), and Tom Dumurray. Standing, Front row, Luther Kirk (left), Don Rhinehart, Verdill Caudill, Worley Mace (left), George H. Deike, chairman of the board, captain, and Kenneth Dixon. Rear row, D. B. Fawbush, Mine Safety Appliances Co.; Harrison Sparks, captain of the safety director, Charlie Bundy, William Duncan and R. P. team, and team members Russell Tackett and Vernon Bailey.

Hightower, coach.

Washington, D. C. C. M. Dovidas, U. S. Bureau of Mines, Vincennes, Ind., was chief judge at the first-aid contest, and T. R. Mark, USBM, Harlan, Ky., was chief judge at mine-rescue events. Master of ceremonies at the awardpresentation banquet was George C. Trevorrow, director of safety, Bituminous Coal Operators Association, Washington.

Runners up to Compass No. 1 in the first-aid competition were:

Second - Ireland mine, Hanna Coal Co.; Donald Tennant, captain; Joseph A. Holmes Safety Association trophy.

Third - Holden Div., Island Creek Coal Co., also winners of first place in combination events; National Coal Association trophy for first aid.

Fourth - Harewood No. 1, Semet-Solvey Div., Allied Chemical Corp., James Criniti, captain; Mine Safety Appliances Co. trophy.

Fifth-Georgetown Preparation Plant, Hanna Coal Co., Delmas Brown, captain; United Mine Workers of America

In mine rescue competition, runners

Second-International Harvester Co., Benham, Ky., Verdell Caudill, captain; Joseph A. Holmes Safety Association trophy.

Third - Holden Div., Island Creek Coal Co.; UMWA trophy.

Fourth - Lynch District, U. S. Steel Corp., Ted Hollin, captain; NCA tro-

Fifth - Frick District, U. S. Steel Corp., Walter Vicinelly, captain.



FIRST IN COMBINATION EVENTS: HOLDEN DIV., ISLAND CREEK COAL CO.-Kneeling, Gary Reeder (left) and Walter Jaap. Second row, Clyde Perry (left), James Adkins, team captain; Carl Adams and Adolph Petzold. Third row, Ernest Sheppard (left), Elmer Layne, coach, and C. E. Linkous, safety director, Island Creek Coal Co.



IRELAND MINE, second in first aid-First row, Evan Adams (left), superintendent; Ross Raley; James Westfield, USBM; Donald Tennant, captain; Lewis Jesalowsky, Ireland safety inspector; and Ewalt Herzog, safety director, Hanna Coal Co. Second row, Andy Janowski (left), Harman Mowrey, Marion Haligowski, Patsy Oliveto, Joe Domenick, Clyde Gibson, general superintendent, and Clyde Smith.

Foremen's Forum



Moral Implications In Safety

GRUMPY PEOPLE, taking their personal troubles to work, are dangerous to themselves and others.

IT CAN BE DEMONSTRATED that there are moral implications in this business of safety in an industry. An example or two may help us see this. Let's look at Joe Who Blow. He's a nice guy, pays his dues regularly, never beats his kids (except in self-defense) and never fights with his wife (since he's found he

So we call Joe an average man. Watch now as Joe becomes a threat to himself and you. His boy falls and breaks his arm. His teen-age daughter is picked up by juvenile authorities. His mother-in-law shows up for a short visit (just year or two). Last night Jane Blow blew up about the budget. Why doesn't he quit mining and get a decent job in a factory?

This erosion of the soul is insidious. He feels inadequate, inferior, anxious. Finally he gets angry. As a fellow worker, you notice he's sour, jumpy and won't speak. At this point Joe is an accident on its way to happen.

He makes a careless mistake in loading his round and the resulting premature explosion injures both Joe and his partner. There goes the record. The pay check suffers. The family suffers.

As you might expect, there's a moral to it. He who is wrapped up in himself gets rapped. And so do those around him

Each of us can say, "As long as what I do does not injure another person, it's OK for me to do it." Come, now! Do you really believe that? The person in industry who is carrying a grudge (against someone outside the mine) is downright dangerous. He can yell his fool head off that such things are his business only. But he's wrong!

This same joker can say he doesn't hurt those working on both sides of him. He may be right. However, morality cuts both ways in an accident. If I fail my job, refuse to be responsible for myself, I need to face the fact that I've decided I can be careless about myself. This is just not so!

I don't have the right to make a mess out of my hand in a belt or to smash my foot under a piece of timber. Why? Because it affects others, whether I like it

So we would say that morality is not just preacher stuff, nor is it a simple business of good manners. Truth is, a moral man or woman happens to be a person who is growing up. It takes some degree of maturing to be safe.

Next, a moral man or woman is a responsible person. You recognize you can't live alone on the job or in the matter of safety. If I would ever want to suggest a prayer, it would be "God deliver me from being immature and irresponsible."

Really now, would you want to have an angry, anxious, fearful man working next to you? I suppose you all have heard the famous statement "He's accident prone."

All we are saying is that a mature and responsible person is safety prone.. I'm sure you figure your life can last longer if you can depend on the fellow working on either side of you.

Fine! We want the other guy to be moral. Be careful, though. Don't be a parasite. You know what a parasite is person who goes through a revolving

An article by Wade L. Carter, minister of the First Congregational Church, Everett, Wash., in the September, 1961, issue of Safety Newsletter, a publication of the Coal Mining Section, National Safety Council.



sure, it's LESCHEN Red-Strand!





You are on the right track here. For the big lifts or ordinary loads Leschen Red-Strand is universally accepted and demanded by wire rope users who expect and get their money's worth. • Constant research and development have provided Leschen users with a complete range of sizes and types for every conceivable task. This versatility, backed by Leschen's distribution and technical services, is your assurance of wire rope dependability for every job. • Accept nothing less than Leschen. For the name of your nearest Leschen distributor write: Leschen Wire Rope Division, H. K. Porter Company, Inc., 2727 Hamilton Avenue, St. Louis 12, Missouri.



LESCHEN WIRE ROPE DIVISION H. K. PORTER COMPANY, INC.

Foremen's Forum (Continued)

door on someone else's push. It isn't enough to be sure of the characters who work around you.

The final proposition is simple to figure out. Can you say that you are a moral person? Regardless or in spite of what the other person does? Probably not in the ideal sense. No one is or can be. You don't have to be perfect for safety in a mine.

But you are always trying to improve, to be more careful, to be more thoughtful. You start where you are. You improve your human relations. You grow, not in terms of someone else, but in terms of yourself.

Don't get too self-conscious. The too-careful person is dangerous, but that's another article. Do the best with what you have.

tities delivered by the fans at these mines ranged from 102,000 to 200,000 cfm.

From these data he calculated that in the winter months water is removed from the mines by the ventilating current at rates of from 21 to 69 tons in 24 hr. In the summer months moisture is deposited in the same mines at rates of from 12 to 23 tons in 24 hr.

It is evident that seasonal changes in temperature radically affect the dust conditions in underground workings. Suggestions have been made that underground workings be humidified during these dry periods. In fact, a number of humidifying installations have been made at various times. In the past, when colliery-produced steam was almost universally available, exhaust steam was discharged in intake air shafts at some mines in attempts to humidify the air. The problem of fine coal dust was a matter of concern to mine operators even back at that time when all methods were geared to producing lump coal.



ESPECIALLY IN COLD WEATHER, rockdusting to highest standards and other dust-control steps are vital.

Mine Dryness – A Winter Hazard

A LOOK AT THE RECORD and a resort to one's memory will clearly show that mine explosions are more prevalent and violent in the late fall and winter. The underlying reason is a sneaky drying out of the mine workings as the cold weather comes on.

The principle involved is very simple —warm air can carry more moisture than cold air. Let's probe a little further.

The air temperature in the mine is relatively constant at from 65 to 70 F. In the summer, when the temperature outdoors is higher than that in the mine, the intake air is chilled as it courses through the mine workings. The air in cooling off loses some of its capacity to carry moisture and this excess moisture is deposited in the mine. You have seen it dripping from the mine roof in the summertime.

In colder weather, when the tempera-

ture outdoors is lower than that in the mine, the intake air is warmed to mine temperature as it passes through the workings. Warming of the air increases it moisture-carrying capacity. Moisture from the mine roof, from mine dust or wherever it is available in the mine environment is entrained as vapor by the passing air and transported out of the mine.

How much water?

Is the effect of this drying process really noticeable? Let's see about that.

Many years ago, H. N. Eavenson, a noted mining engineer, prepared tables that show the average monthly weight of water vapor and average monthly temperatures outdoors in the Appalachian coal fields. He then studied the humidity conditions in a number of mines in southern West Virginia. Quan-

More dust now

But now coal is milled from the face, creating an enormous increase in fines. In most instances where continuous mining is the chosen method, the velocity of the air is higher, thus transporting and depositing coal dust in the returns, unless strict preventives are applied.

The upshot is that dust-control discipline must be much more strict in modern, mechanized mining, and primary reponsibility for this discipline rests on mine foremen and their assistants.

Rockdusting must be adequate the first time around to provide the necessary incombustible content. However, there must be a followup. Float dust will tend to dilute the beneficial effects of the original rockdust if reapplications are not distributed as needed. This means that periodic mine dust samples should be taken and analyzed for incombustible content.

Remember, dust control is important at all times, but especially in the winter.

Coming in December . . .

The seventh in a continuing series of Coal Age Operating Guides, covering fine-coal cleaning, drying, water treatment and water handling, now in preparation by our Associate Editor, A. E. Flowers, will be published in the December issue.

Top management and preparation officials will want to check this guide for up-to-date information on fine-coal processing, which is one of the greatest challenges facing coal operators today.

O-B Designs For Mining Men **RESULT:**

A 4-way expansion unit that holds in soft shale or hard rock



4-WAY EXPANSION UNIT BUILDS HOLDING POWER FAST... because the flexible fingers of the shell are slightly pre-expanded to grip the wall even before wrenching begins.

GOES UP FAST AND STAYS PUT. When the bolt is shoved up the hole, the expansion unit holds the bolt in place until it's tightened . . . no need to have hands exposed to injury during wrenching.

GREATER STRENGTH IN HARD TOP... BETTER "PURCHASE" IN YIELDING TOP... because the expansion pressures are spread evenly over the four shell fingers to make the best use of the entire unit's strength. These are the reasons for the O-B Expansion Unit's popularity with mining men. It is easy to understand why more mine roof is supported with O-B Shells and Plugs than with any other kind.

For further information and prices, see your local O-B sales-engineer or write us now. Ohio Brass Company, Mansfield, Ohio. Canadian Ohio Brass Company, Ltd., Niagara Falls, Ontario.

Ohio Brass



EXPANSION SHELLS AND PLUGS . LINE MATERIALS . SAFETY AND CONTROL EQUIPMENT . ELECTRIC HAULAGE MATERIALS

10048-M

Operating Ideas



LOW-FLYING HELICOPTER, latest tool in spoil reclamation, speeds seeding of leveled spoil banks at Hanna Coal.



SPECIAL FEEDERS, one on each side of helicopter, are calibrated to release 22½ lb of crown vetch mix per acre.

Reclamation Project Yields A Profit

A PROJECT that originally had as its goal the control of erosion on spoil banks is now turning in a profit to the Hanna Coal Co., Cadiz, Ohio. Today Hanna processes crown vetch seed for its own reclamation program and sells the excess to large seed houses. Crown vetch is especially valuable on slopes for erosion control and Hanna has learned that it is an excellent forage crop.

About 6 yr ago Edwin Mills, manager of Hanna's reclamation department, became interested in crown vetch as a cover crop to prevent erosion on graded mine spoil banks. He had noted how thick and lush it grew on cut and fill

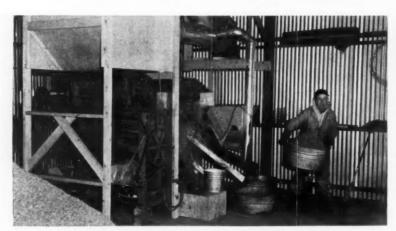
slopes along roads and decided that it had a place in Hanna's reclamation program. Crown vetch at that time was considered good only as an attractive cover for roadside slopes. It was considered poisonous to cattle and never was planted as a forage crop. But it never had been established that crown vetch definitely was poisonous to cattle.

After a crop of 'crown vetch was established, two steers were turned into a pasture containing both crown vetch and regular grazing forage to study the effects of crown vetch on cattle. Many times the steers were seen eating the crown vetch and no after effects were

noted, thus proving it non poisonous.

In 1957, three steers and eight lambs were pastured on a four-acre plot of land seeded exclusively with crown vetch. In addition to observing no ill effects on the cattle as a result of eating the crown vetch, weight gains were noted comparable to another test group being fed on good alfalfa. In 1958, the experiment was duplicated with 12 head of cattle and no ill effects were noted. Results of these tests proved conclusively that crown vetch not only was nonpoisonous to cattle but was an excellent forage crop.

Crown vetch is a long-lived perennial

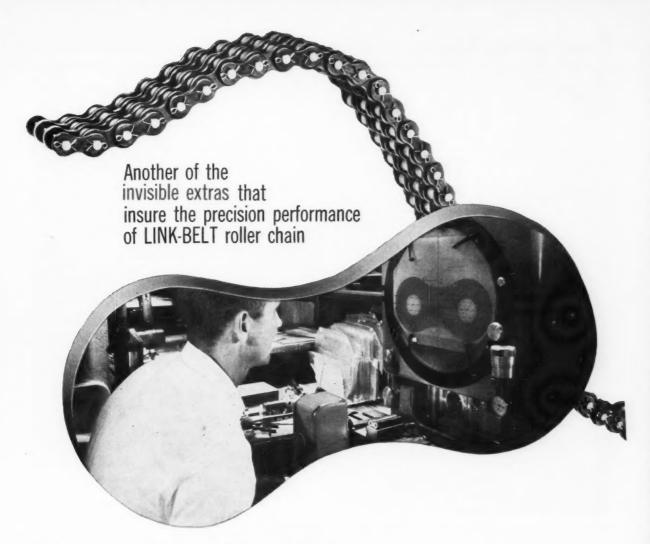


SEED-CLEANING machinery in company plant separates hulls and chaff from seeds.

Plant processed 27,000 lb of seed in past year.



BAGGED SEED is inspected by Reclamation Manager Edwin Mills.



Optical comparator inspection guarantees

precision of every part

Precision is rigidly practiced in every step of Link-Belt's roller chain production. The optical comparator is an example of the specialized equipment used to assure precise manufacturing control of chain parts and tools. It is capable of magnification up to 100 times.

Continuous inspection is just one of the *invisible extras* that contribute to the greater strength and endurance of Link-Belt roller chain. Others include precise heat-treat control, prestressing,



Double- and triple-strand LINK-BELT steel roller chains easily handle the heavy loads encountered by this storage table drive.

pitch-hole preparation, shot-peening and burnishing of rollers.

These features—plus painstaking precision in every step of manufacture—assure you of chain that can easily cope with today's heavy loads and high drive speeds.

For engineering assistance in applying industry's preferred roller chain, contact your nearest Link-Belt office or authorized stock-carrying distributor. See CHAINS in the yellow pages of your phone directory.

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7;



Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.

Operating Ideas (Continued)

and is different from other legumes in its ability to spread from underground rhizomes. After the third year it begins to form a dense ground cover. It can be grazed off the top and still spread under ground. It has deep roots that seek out the moisture in porous ground found in spoil banks.

With the use of a helicopter and an airplane Hanna's reclamation department this spring had some 1,100 acres of graded spoil bank seeded with a crown vetch mixture. In addition to the crown vetch, the mixture includes sweet clover, alfalfa, and orchard grass, which provide early cover.

During the first 2 yr the seed which is mixed with the crown vetch will furnish the only visible cover. About the third year the crown vetch will start making its appearance and begin to dominate the area.

Flying only 50 ft above the ground, a helicopter or airplane can seed an acre of leveled spoil bank in 13 sec. The Kelicopter carries a special seeder which is calibrated to distribute 22½ lb of the seed mixture to each acre. This mixture includes 12 lb of crown vetch, 6 lb of sweet clover, 3 lb of alfalfa and 1½ lb of orchard grass.

Hanna management notes that although the helicopter is the latest tool for reseeding, a conventional fixed-wing airplane with a seed distributor designed by the Agricultural Engineering Department of Ohio State University has been the work horse in the seeding program and probably will continue to be. But the company is getting comparative

costs and studying safety factors of the helicopter also.

Last fall previously seeded areas were harvested and during the winter members of the reclamation department built a seed recovery plant. They converted an old Clipper model seed and grain cleaner into an efficient cleaning unit for processing the harvested crown vetch seed.

The plant processed about 27,000 lb of crown vetch for use in 1961. This was a larger quantity than needed by Hanna this past spring, and several large seed companies inquired about buying the surplus. Hanna notes that there is only a limited commercial supply of seed available, because of the increased demand for use on slopes, and the price is high.



REGULAR drainage of water from the fuel filter housing and fuel tank helps prevent frozen fuel lines.

Fuel Systems Need Special Winter Care

WHEN TEMPERATURES start dropping in the fall, tractor owners are quick to protect cooling systems against an unexpected freeze. But often they forget to check possible collection of water that is equally as certain to shut down a tractor as frozen coolant. They forget, that is, until the morning after the first hard freeze when they have to wait for the temperature to climb high enough to melt ice blocking the fuel system.

One such reminder usually is enough to keep them taking special care of their fuel systems for the rest of the winter. They can avoid the reminder and resultant delay, however, by starting winter fuel system care as soon as the first freeze threatens. What does special winter fuel system care for a tractor involve? Check the following suggestions for some useful ideas.

The most important thing is to keep moisture out of the system, according to the Service Dept., Caterpillar Tractor Co. Cool temperature condenses moisture from the air. Thus during cold nights, as the air in the top of the fuel tank cools, water forms and settles to the bottom. From there it can travel through the fuel system, settling in low places in the fuel line and in the base of the fuel filter housing. When

the tractor stands overnight in freezing weather, these collections of water turn to ice.

Frozen fuel lines need never stop a tractor, however. Simply filling the fuel tank at the end of each day's work drives out all moisture-laden air and almost entirely eliminates water from condensation. In spite of evening refuelings, though, some moisture will get into the system. Since it is heavier than diesel fuel, it settles in two predictable places: the fuel tank and fuel filter. Caterpillar-built tractors have drains in those two spots for removing water.

The first is at the base of the fuel tank. In warm weather, water should be drained from the fuel tank before starting the engine in the morning. This procedure assures that only clean fuel will leave the tank that day. In freezing weather, however, an owner takes a chance on a possible freeze-up by waiting until morning to drain collected water from the fuel tank. Instead, he should drain it at the end of the day, after allowing the tractor to sit a while to give the water a chance to settle. Caterpillar suggests that, during summer operation, water in the fuel tank be drained every 125 service meter hours. To be safe in the winter, drain it every 50 hr. These service periods assume the tank is being filled each evening.

The second moisture drain on Caterpillar fuel systems is at the base of the fuel filter housing which contains a sump to trap any remaining moisture carried in the fuel. When the temperature is below freezing, trapped water in the filter housing should be drained each day before the operator goes home at night. Trapped air may have to be bled from the system after moisture is drained from the filter housing.

The pour point of the fuel being used also has to be considered during cold weather. To assure free fuel flow, use fuel with a pour point at least 10 F lower than the lowest ambient temperature during working hours. Such winter-grade fuels are available in most areas.

Don't wait for freezing weather, though, to change to winter-grade fuel. Wax in summer-grade fuel may start to gel at temperatures above freezing, partially plugging the fuel filters. Since wax content is the prime factor affecting the pour point, switching to low pour point fuel early in the season will reduce the danger of filters becoming clogged by wax during sub-zero weather.

Regardless of when you change to winter-grade fuel, watch the pressure gage more closely than usual. It tells you when your filters are becoming clogged. And there's greater danger of clogging when the weather turns cold. SELECT THE CABLE MADE BY THE FAMOUS "MINE-TO-MARKET" FAMILY ...





Phelps Dodge Mining Cable

- Made of highest quality copper from Phelps Dodge's own open-pit mines.
- Combines years of Phelps Dodge mining "know-how" with many years of cable manufacturing experience to give you the finest quality cable you can specify.
- Assures utmost protection against damage from mechanical and electrical hazards in both above and below ground mining operations.
- Listed by the U. S. Bureau of Mines, and approved by the Department of Mines, Commonwealth of Pennsylvania, P-114-BM.

First for Lasting Quality—from Mine to Market!

PHELPS DODGE COPPER PRODUCTS

CORPORATION

300 Park Avenue, New York 22, N.Y.



New Equipment News



Power-Shift Transmission Featured on Scraper

New production advantages, including greater capacity, less deadweight, simplified controls and an optional all-new transmission have been announced for the B Tournapull scraper.

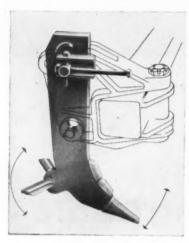
The "Powerflow 700" transmission is a constant-mesh, coun-

ter-shaft-type unit with full power-shift and torque-converter. Because its double-acting clutches cannot engage simultaneously, the two major causes of "shift-shock" have been eliminated, i.e., gear "underlap" and gear "overlap." And the remaining cause of shock has also been eliminated, in that "aggressiveness" is made impossible because of the design of the unit's clutch friction members.

The B's 18-in torque converter is gear-coupled, mounted "midship" and attached to the generator. Integral sump design and all converter fluid which is full-flow filtered are featured. In addition, the problem of "over-riding clutch" is eliminated because the stator is stationary.

This new Model "B" scraper has 25 yd struck, 32 yd heaped capacity. When fully loaded, the "B" offers a power-/weight ratio almost exactly the same as the previous, smaller-capacity model. Reason: close to 5,000 lb of "deadweight" have been trimmed from the machine. Both the apron and bowl-hoist are now controlled by a single motor, rather than one motor each. Another important change is that the scraper is now controlled by three knobbed levers which provide instant-feel-of-the-load response. Many other design improvements have been made.

LeTourneau-Westinghouse Co., 2301 NE Adams St., Peoria,



Rugged Ripper

An extremely rugged Rapid-Adjust Cam Lock ripper with new one-piece ripper point has been placed on the market.

Both shank and point are forged of special high-alloy steel and formed under a recently devised heat-treating process to create proper grain flow for extreme strength, stamina and wear-resistance.

With the new assembly and using only one H&L shank and point, an operator can achieve four ripping angles with ease and speed, reports the manufacturer. Forward or rear position is attained by simple adjustment of the cam lever while two additional angles

are achieved by reversing the quicklychanged Flexpin-attached point. Twin wear plates are said to increase shank life several times and cut replacement costs by permitting reinstallation at point of maximum wear. They are replaceable and are available separately or as a set. Specially processed to withstand heavy impact and severe abrasion, this ripper point is also designed to stay sharp throughout long life.

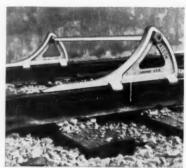
In conjunction with the new ripper, H&L is now marketing a new, replaceable drop-forged alloy cutter wing that efficiently loosens difficult and compacted materials. Self-locking Flexpins exert constant pressure for firm connection while permitting free flapping action during ripping.

H&L Tooth Co., 1540 S. Greenwood Ave., Montebello, Calif.

Two Products Improve Rail Safety

The Aldon Co. has introduced two new products designed to improve rail safety conditions.

In upper right photo, a friction-type rail skate guards against car puller runaways and possible drifting toward the main line or dead end of the track. This device has also been designed for spot stopping at warehouse doors and docks. Weighing 95 lb per set and easily portable, it can be instantly applied or removed from the track without tools.





Lower photo illustrates the new portable, double-tension-type Safety Wheel Chock. Reported ideal for piggy-back car blocking, this type B-2 unit eliminates car motion during loading and unloading. It has two chocks drawn tight and locked to both sides of the wheel by load-binder action. Handles are provided.

Aldon Co., Dept. N., 3338 Ravenswood Ave., Chicago 13, Ill.



We've got an explosives expert on our staff at no extra cost...

Every Austin customer can make this statement! Austin representatives offer more than a complete line of explosives and blasting supplies. They provide supporting technical information vital to your efficient use of these products.

Each Austin representative is qualified by education, training and experience to recommend the most effective explosive . . . most economical method of blasting . . . correct blasting supplies . . . best storage and handling facilities . . . everything needed for best results.

Also available is knowledge contained in countless case records compiled by Austin technical representatives during the company's 128 year history. These list patterns, burden, water conditions, and the explosives recommended. By comparing latest techniques with past experience, guesswork can be virtually eliminated.

Your job may require a special mixture. Here, too, your Austin representative always proves invaluable, for he will employ services of the Austin research and manufacturing departments to develop practical solutions to your problems.

It's easy to put an explosive expert on your staff at no additional cost.

Call your Austin representative today.



AUSTIN POWDER COMPANY

Cleveland 13, Ohio

Tractor Shovel Features Power Steering, Brakes

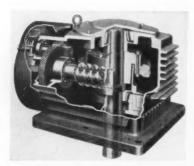
Full hydraulic power steering and oil-cooled power brakes are featured on the HD-7G tractor shovel which has a capacity of 1% cu yd. Both clutches and brakes, which run in oil, have been specifically designed to reduce brake adjustments and provide for self-adjusting clutches.

Powered by a 100-pp Allis-Chalmers turbocharged diesel engine, the HD-7G's torque-converter performance is combined with a new, single-lever power-shift transmission featuring the company's exclusive "Ground Speed Control" governor. The governor allows the operator to preset any working travel speed to match job conditions. The tractor will move constantly at the preset speed when load is lightened or increased up to the full power of the engine. Finger-tip shifting on the go permits working speeds up to 5.9 mph forward and 4.2 mph reverse.



In addition, a wide variety of quick-mounted front attachments are offered.

Allis-Chalmers, Construction Machinery Div., Milwaukee 1, Wis.



Speed Reducer Efficiency Raised

The efficiency of high-ratio worm-gear reductions has been increased through the use of a helical and worm-gear double-reduction combination in the new HUF and HDF speed reducers. Ratios range from 35:1 to 250:1, while ratings range from fractional to 60 hp. Output torque capacities run as high as 145,000 in lb. The units are offered with output shafts extending either upward or downward (as illustrated).

Helical and worm gearing run in a large-capacity common oil bath for effective cooling and lubrication. HDF units, which have the downward output shaft extension, use a dry-well construction to avoid the hazard of oil leakage.

Insuring a balanced design, the helical gears are designed to withstand the same momentary overload of 300% of rated load as the worm gearing. HDF worm gears are either solid or have rims welded to cast iron hubs. HUF types, however, are cast to a cast-iron hub that has a double row of lugs for mechanically keying the bronze ring to the hub or have flanged-type rims bolted to the hub. Aluminum or plastic cooling fans, mounted on the high-speed pinion, insure adequate cooling of the heavily-finned cast-iron housings.

Cleveland Worm & Gear Div., Eaton

Mfg., Co., 3300 E. 80th St., Cleveland 4, Ohio.



High-Density Blasting Agent

Because of the higher density and velocity of Austinite 30 blasting agent, wider spacing of blastholes is permitted where conditions suggest its use.

It possesses a density of 1.2 and a speed of 14,000 ft per sec. Previously, blasting agents employing primarily ammonium nitrate had not been able to achieve such high detonation rates when density was 1.1 or above.

Austinite 30 is offered in spiral-wrapped fiber containers 4½ to 9 in in diameter. Similar packaging is available for Apcomite 30, a companion product with a self-contained primer.

Austin Powder Co., Cleveland 13, Ohio.



Tractor Dozer Engine Option

A 170-hp General Motors diesel engine—Model 6V-53—is offered as optional equipment for the "Michigan" Model 180 tractor dozer.

Designed to increase the tractor dozer's flexibility and production, the new engine features two-stroke engine cycle, unit injector fuel system and maximum parts interchangeability. It is driven through the Clark power train with a top speed of 27 mph, forward or reverse.

Dozer blade action is hydraulically controlled on the tractor-dozer through lift, pitch and tilt cylinders. Measuring 10 ft 2 in wide and 3 ft 1 in high, the standard dozing blade for Model 180 cuts to a maximum 2 ft 4 in below ground level. Total angle of blade pitch control is 35 deg, with maximum blade tilt, 7 in. Blade raising or lowering speed (full stroke) is 53 fpm. Other blades available include a special coal-handling blade and an angle blade. For further information write to . . .

Clark Equipment Co., Construction Machinery Div., Pipestone plant, Benton Harbor, Mich.



Lowest Haulage Cost Per Ton!

... that's why KW-Dart gets so many repeat orders for these units

30 years of working with the coal industry has given KW-Dart engineers a thorough knowledge of the problems of mine hauling operations: specific variations in pit widths, types of haul roads, grades, hauling distances, and loading shovel capacities. All these factors influence the design and building of KW-Dart haulers.

As a result — KW-Dart's job-proven coal haulers offer you maneuverability, a payload range of 50 to 100 tons, and a world-wide record for long service-life, minimum downtime, and smooth, safe operation.

For information on how KW-Dart haulers can boost your production, and lower your costs, write . . .





Tractor Shovel Lifts 13,000 Lb

Nelson's latest four-wheel-drive tractor shovel—Model 250D—lifts 13,000 lb in a "Contractor"-type bucket that permits a 60-deg dumping angle. This angle is particularly valuable on jobs handling wet, sticky materials and for backfilling trench work.

Standard features include full powershift transmission, planetary axles, power steer, power brakes and full-vision underslung-type safety arms. Complete accessibility to all components is also claimed for the unit.

With Models 150 and 200, previously announced, bucket capacities now range from 1% to 4 cu yd.

N. P. Nelson Iron Works, Inc., 850 Bloomfield Ave., Clifton, N. J.



Level Controller

A simplified controller for maintaining correct liquid-level measurement can be applied to almost any size or type of vessel and provides continuous level indication or control. Using the Geiger-Mueller principle of radiation detection, the controller has sensing heads (at right) housed in thick steel tubes to meet explosion-proofing requirements. Each head is 6 in long and can be increased by 6-in increments to meet specific applications. Without moving parts, the instrument is installed so there is no contact with the material being measured.

Recording and other instruments may be placed within a radius of 500 ft from the controller. Thermal stability is between 60 and 150 F, permitting accurate readability in temperature extremes. Time constant is about 70 sec for 63% of ultimate reading. The large, easily read-unidicating meter (at left) is graduated from 0 to 100 for readout.

Ohmart Corp., 4241 Allendorf Dr., Cincinnati 9, Ohio.



New Transmission For Mobile Units

A new system of hydrostatic transmission, developed for off-the-road mobile equipment, has been tagged "Dynapower" by its originator.

Essentially, the new transmission consists of a variable-displacement axialpiston hydraulic pump coupled directly to the vehicle's engine and a fixed displacement hydraulic motor which drives directly into the differential.

An important feature is the high-pressure hoses since they replace the conventional drive shaft, universals, gear changers and clutches. The position of the pump's variable cam determines the speed and direction of rotation of the hydraulic motor.

Other important advantages include: (1) full torque at low engine speeds—even idle—which eliminates the tendency for the vehicle to run away with itself when the peak torque requirement abruptly disappears; (2) infinitely variable, stepless speed ratios; (3) reduced brake maintenance—transmission itself can handle all service braking requirements; (4) easy operation—a single control determines both direction and speed; and (5) faster, yet smoother response to direction changes.

Watertown Div., New York Air Brake Co., Starbuck Ave., Watertown, N. Y.

FILTER - COLLECTOR — Pre - assembled, individual sock-cage construction, referred to as "Uni-Cage," is featured on new Trans-Vair filter collectors. This construction innovation permits removal of individual cage and sock assemblies and immediate replacement of completely-assembled spare parts. Hence, downtime is reduced to a matter of minutes. Another advantage results from the use of special lightweight castings as an integral part of the dusttight bag frame;



e.g., the necessity of clamping over cages or wire is avoided.

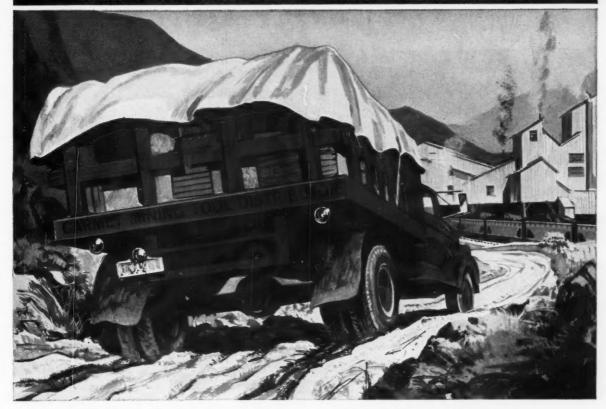
These filter-collectors operate on highor low-pressure impulse air controlled by solenoid valves and actuated either manually or by an electrical timer.

Horizontal and vertical configurations are available, with the compact horizontal design offering an additional advantage where headroom is somewhat limited. Three standard models cover 18 different capacity ranges with filter area from 6.8 to 368.4 sq ft. Young Machinery Co., Inc., Muncy, Pa.



RESPIRATOR—Major characteristic of the redesigned "Comfo" half-mask respirator is an improved facepiece seal which provides for a greater range of facial shapes and sizes. The seal includes an inturned lip and deep chin-cup cushion supported by a four-point suspension system. This yoke-type suspension eliminates pressure points, thereby insuring greater comfort by distributing retention pressure more uniformly around facepiece periphery.

Light in weight (4.3 oz), Comfo is also easy to clean and maintain. Inde-



Your best bet in Mining Tools... your <u>coal country</u> Carmet® Distributor

Local people sell Carmet Mining Tools. Because Carmet believes in, and recommends, business on the local level. Your Carmet Mining Tool Distributor is a home town business man . . . a local employer. His prosperity stays in the local business community.

And, local buying is your best way of buying. Because each Carmet Distributor is selected on his own merit, and on his ability to offer specialized service in his own mining area. He can make his mining tools perform in *your* conditions. Because he knows what you're up against. And because he is a mining tool specialist. Carmet sees to that.

Your Carmet Distributor has plenty of support. Because Carmet sees to that, too. Carmet backs-up their distributors with direct plant engineering service... any time, anywhere. The 7 leading Service Engineers total over 154 years of direct coal mining

experience. The oldest is 49. And they, in turn, have the industry's most complete line of carbide grades behind them.

This carbide is Carmet Carbide, of course . . . famous for quality. Carmet manufactures the bit completely, and stands behind it . . . completely. Nobody makes it for us. Because nobody can do it well enough. Call your local Carmet Distributor today, and let him show you the best Mining Bit that know-how and money can build. You owe it to your community. You owe it to yourself.

CARMET A

CEMENTED CARBIDE. DIVISION OF ALLEGHENY LIIDLUM

FOR QUALITY . CARMET — FAMOUS FOR QUALITY . CARMET — FAMOUS

pendent replacement of many parts is an added attraction. Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.



COMPRESSOR, TRACTOR—The Series 62 heavy "Pneumatractor" is a complete compressor/tractor package that provides a multiuse unit for all types of contractors, industrial plants and other users at far less than the cost of individual pieces of equipment.

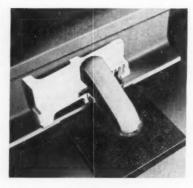
Basically it is a self-propelled 125-cfm air compressor capable of mounting a wide variety of accessories such as backhoe and loader (as in photo), rock drills, etc. The compressor features "controlled delivery," a new development which permits selection of 42-, 84- or 125-cfm capacity as required making possible the operation of pneumatic tools at the same time an accessory is being used. All accessories are attached to an independently-mounted box steel frame.

Other new features include a clearvision panel board, redesigned clutch and brake pedals with individual wheel braking, improved hydraulic steering as standard, heavy-pressed steel wheels and new, handy double-use swing seat. Gasoline and diesel units are available. Schramm, Inc., 900 E. Virginia Ave., West Chester, Pa.



FILTER MASK – This "3M" featherweight filter mask combines high filtration of nontoxic dust and sprays with comfort. Made of a nonwoven fabric, No.

8200 masks are said to provide 3 to 5 times more filter area than other masks because they are all filter. Shaped to stay away from nose and mouth, they conform to any face and allow easy breathing. Minnesota Mining & Mfg. Co., Dept. P1-500, 900 Bush Ave., St. Paul 6, Minn.



SPRING BRACES — This new spring brace permits accurate lateral adjustment of railroad track to maintain proper gage dimension.

It consists of three simple parts—a cast-steel wedge, a backing block of the same material and a high-tensile spring. Since it is free of nuts, bolts and washers, tightening with a track maul or similar tool takes only seconds. Taylor-Wharton Co., Div. of Harsco Corp., Cincinnati 12, Ohio.



DIESEL IMPORTS—Small, Germanbuilt diesel engines in five power sizes are said to be ideally suited as power sources for water pumps, generators, conveyors, lift trucks, compressors, cranes, etc. Models range from 2-cyl, 66.3 cu in displacement to 4-cyl, 132.7 cu in displacement (photo).

Direct-starting, the imports are valvein-head, sleeved engines with 19.1 compression ratios and range from 15.8 to 39.6 maximum hp. An outstanding design feature is the interchangeable parts including connecting rods, main and connecting rod bearings, valves, valve springs, push rods and rock-arm assembly components. Crankcases for all five engines are machined from three basic blocks. Pistons and sleeves are of two

These units are products of International Harvester's subsidiary, Neuss Works, Neuss, West Germany, established in 1908. Competitively priced, the Neuss units supplement the International line. Their addition, International says, will offer manufacturer-customers interchangeability features between the German-made diesels and the small U. S.-built International UC-60 and UC-135 engines. International Harvester Co., Construction Equipment Div., 180 N. Michigan Ave., Chicago 1, Ill.

Equipment Shorts

Rock Drilling—"Drillalloy" rods, made of the company's own special-analysis steel with a large blow hole, are available in 1½-in round for use with rope threads. Shot-peened to insure added fatigue resistance, they may be rethreaded on the job without heat treatment. Uncoupling is by hand—no wrenches necessary. Brunner & Lay, Inc., 9300 King St., Franklin Park, Ill.

Cleated Belt—Constructed of molded pocket ribs and dams, the new Cleat—Top Belt can be raised as high as 21 deg at 250 fpm belt speed without slipback of conveyed material. Offered in widths from 12 to 48 in in any ply combination and in several different grades of rubber. Hewitt-Robins Incorporated, 666 Glenbrook Rd., Stamford, Conn.

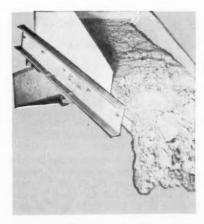
Truck Line — Dodge recently introduced its 1962 line of trucks featuring a new compact delivery unit and new contemporary styling. With 141 basic models, the new line includes conventional-cab, LCF, forward-control chassis, four-wheel drive and tandem units, with gww ratings to 53,000 lb and gcw ratings to 76,800 lb. Dodge Div., Chrysler Corp., 7900 Joseph Campau, Detroit 31, Mich.

Flange Bearing—Latest addition to the "Life-Lube" ball-bearing line is a flange-type housing with two drilled holes, accurately spaced to allow interchangeability with most other makes of bearing units. Housing has a spherical bore to permit the bearing to self align. The bearing is locked to the shaft by a self-locking eccentric collar which mates with an eccentric cam on the wide inner ring to provide a precision fit on the shaft. Since bearing is life-sealed, lubrication is not needed. Offered for shaft diameters ranging from ½ to 1½6 in. T. B. Wood's Sons Co., Chambersburg, Pa.

Diesel Engine—The Allis-Chalmers 4cyl D-175 diesel engine is now offered for commercial use. It develops 49 hp at YOUR WAY The Carrier Amplitrol Feeder Demonstrator Truck. See an actual demonstration of the greatest advance in vibrating feeders. You get less maintenance...no damping ...precise feeding control... with the simple rugged "MECHANICAL" Amplitrol.



NOW...you can see for yourself... how CARRIER AMPLITROL CUTS FEEDING COSTS!



NATURAL FREQUENCY AMPLITROL FEEDER has only two operating parts...an A. C. motor exciter and rugged pneumatic springs. Discharge rate is controlled by simply changing air pressure in the springs.

WORDS ARE NOT ENOUGH to demonstrate the unique advantages of the Carrier AMPLITROL Feeder. That's why we've mounted an AMPLITROL on a demonstrator truck to show you that seeing *is* believing when it comes to AMPLITROL advantages. You'll see why you'll get:

GREATER CAPACITY...Size for size, AMPLITROL delivers more capacity under greater head load than any other type of vibrating feeder and feeds many "hard-to-handle" materials that other feeders can't.

VARIABLE CAPACITY...From a trickle to a torrent with fully variable stepless AMPLITROL capacity control.

at the feeder or at remote locations—and can be automatically controlled from practically any process or operation.

employs Carrier NATURAL FREQUENCY principle that assures more work with less power...less maintenance cost.

GET THE COMPLETE STORY. Write us on your business letterhead about a demonstration. We are presently scheduling dates and locations for this unit and will be happy to tell you when it will be in your area. Address Carrier Division, CHAIN Belt Company, 221 N. Jackson St., Louisville, Ky.

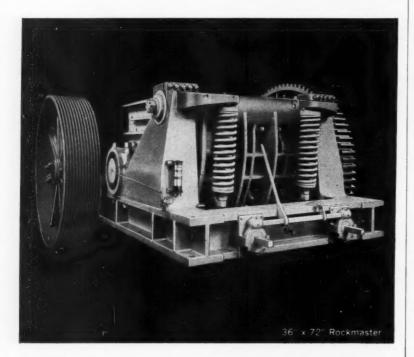
CARRIER



VIBRATING EQUIPMENT

world's FINEST CRUSHERS

for rock, slate and other mine refuse



High in capacity and ruggedly constructed, Rockmasters have the strength for economy and long service in the coal industry's most severe crushing applications. Steelstrut Toggle automatically releases tramp iron, while the Quick-Adjustment controls size ranges. Other advantages: Extraordinary ratios of reduction, lower power and maintenance costs, excellent resale value. Get all the facts from Bulletin RMTD-56.



ROCKMASTERS

McLANAHAN CORPORATION

250 Wall Street

Hollidaysburg, Pennsylvania

2,200 rpm, and has a 3%₁₆ x 4%-in bore and stroke and 175-cu in piston displacement. Other features are replaceable "wet" type cylinder sleeves and full pressure lubrication, which, with efficient air and oil filtering systems, add up to long engine life. Allis-Chalmers Mfg. Co., 986 S. 70th St., Milwaukee 1, Wis.

Portable Pumps — Football-sized %-hp lightweight, portable submersible pumps now offered can be operated from single phase, 115-V power line or an auxiliary 1,000-w generator and handle up to 120 gpm. They operate wet or dry. Design features include precision pre-lubricated ball bearings, double-shaft seals, fused circuits and a special anticorrosive coating. Prosser Industries, Inc., 900 E. Ball Rd., Anaheim, Calif.

Free Bulletins

Belting Fabrics—A technical service bulletin called "XL in Belting Fabrics" compares in graphs, charts, descriptions, the physical properties of XL belting fabric with cotton belting fabric. American Viscose Corp., Product Information Div., Technical Service Dept., Marcus Hook, Pa.

Bearings—A new brochure is offered covering all lines of bearings and bearing specialties for which the company is authorized distributor. Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.

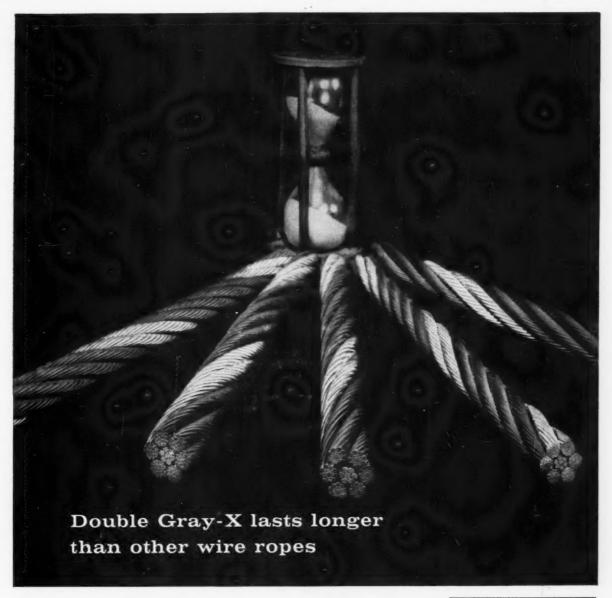
Bucket Elevators—New bucket elevators shipped from stock in kit form for field assembly are described in literature available. Called "Buck-El Lift-It-Kits," the products are centrifugal discharge bucket elevators for elevating bulk materials. Bucket Elevator Co., 24 Commerce St., Chatham, N. J.

Batteries—Complete tables of electrical and physical characteristics are included in Bulletin ML-568 covering the firm's batteries for use in mining operations. C&D Batteries, Div. The Electric Autolite Co., Conshohocken, Pa.

Reducer — Latest addition to the Torque-Arm line is a small shaft-mounted speed reducer, the TD025, for shafts 1½ in or less and for power requirements up to 1 hp at 90 rpm. Request Bulletin 602A. Dodge Mfg. Corp., Mishawaka, Ind.

Drilling—The 60-BH Champion Drill—An electrically-powered rotary-blast-hole drill—fills the 12 pp in Bulletin D-39N. Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa.

Nuclear Technology-A "check list"

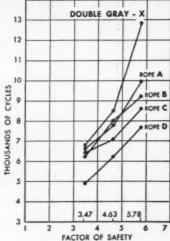


CF&I-Wickwire is making the wire rope of tomorrow...today. It's Double Gray-X—the rope with the molecular shield of molybdenum disulphide.

In an extended series of tests on a 25,000-lb. fatigue machine, CF&I-Wickwire's Double Gray-X outlasted four other major brands of high-strength rope at all three of the safety factors used. At the highest and most commonly-used safety factor, Double Gray-X had 45%

more bending life than the average of other ropes tested. (Please see the chart at right.)

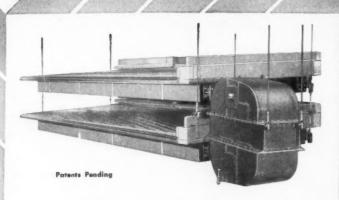
We'd like to give you some additional information on these tests...let you read some enthusiastic field reports from satisfied users... and show you how the molecular shield on Double Gray-X can help reduce your equipment-downtime costs. Contact your nearby CF&I sales office or distributor today.



All test ropes were 1/2" 6 x 25 FW Preformed E.I.P.S. Lang Lay IWRC.

THE COLORADO FUEL AND IRON CORPORATION Denver - Oakland - New York Sales Offices in Key Cities





More—More — More Preparation Less—Less—Less Cost

The ability of the CONCENCO® "77" table with its two identical decks to double production in a given unit of floor space is quite obvious.

And it is easy to visualize the economies made possible by halving of the service connections such as piping, wiring and laundering.

But many other factors also make important contributions to the reduction of your preparation cost per ton. The "77" double-duty table is powered by the same size motor as is required by a single deck table . . . and general overhead costs such as heat, light and supervisory labor are also practically unchanged.

With such economy, it is easy to understand why every important table installation in the past 5 years has included one or more—up to 32—"77" tables.

For full information, send for Bulletin 77.

For Screening Economy

All New Model Leahy® screens utilize proven differential vibration, 1600 v.p.m., that snaps oversize wedging particles loose. When dust is a problem, totally enclosed models are most effective. For damp screening, Flex-Elac® electric heating of the screen jacket insures full-time open mesh. For a ficient wet screening CONCENCO spray nozzle arrangements are your enswer.



THE DEISTER*
CONCENTRATOR
COMPANY



★ The ORIGINAL Deister Company ★ Inc. 1906 909 Glasgow Ave. • Fort Wayne, Ind., U.S.A. of nuclear techniques which NSEC may apply to problems within the mining industries is available for the asking. It is entitled "Nuclear Technology for the Mining Industries." Nuclear Science & Engineering Corp., P. O. Box 10901, Pittsburgh 36, Pa.

Lubricating Oils—Data on Solnus "C", a general-purpose lubricating oil recommended for extremely wet conditions, has been incorporated in the latest revision (No. 17) of Sun Oil's technical bulletin on this line of oils. Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

Electrical, Lubricating Devices—The firm's complete line of electrical and lubricating devices are described and illustrated in Catalog 61. Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, Wis.

Testing Sieves—The 1962 edition of Tyler's 48-p handbook on "Testing Sieves and Their Uses" is now off the press. It contains useful data on selection of Testing Sieves for size analysis of crushed, pulverized or screened products or any study of particle size distribution. W. S. Tyler Co., 3615 Superior Ave., Cleveland 14, Ohio.

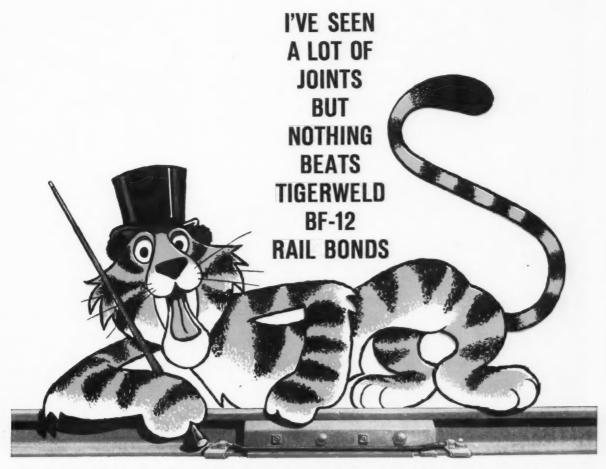
Arc Welding—A request for No. 13 Twecolog will bring you data on electrode holders, ground clamps, cable connectors, lugs and splicers. Special application products are covered in Form MSA-1962. Tweco Products, Inc., P. O. Box 666, Wichita 1, Kan.

Screens and Conveyors — Comco screens which feature true balanced-mass design and point-of-no-oscillation suspension are thoroughly revealed in Bulletin B-100. Comco Corp., 5421 Lancaster Ave., Philadelphia 31, Pa.

Linear Polyethylene—A comprehensive catalog on the use of linear polyethylene in industry especially emphasizes applications within the coal industry. Abutco Plastics Industries, Inc., Hazleton, Pa.

Earthmoving Products—Form No. 327 covers complete line of Euclid equipment, including two models of crawler tractors, eight scrapers, nine rear-dump haulers and three bottom-dump models and two 51-ton coal haulers. Euclid Div., General Motors, Adv. Dept., Hudson, Ohio.

Suspended Magnet—For the latest in suspended separation magnet design, ask for Bulletin 1032 covering Stearns' completely new line of oil-filled suspended separation magnets. Stearns Magnetic Products, 635 S. 28th St., Milwaukee 46, Wis.

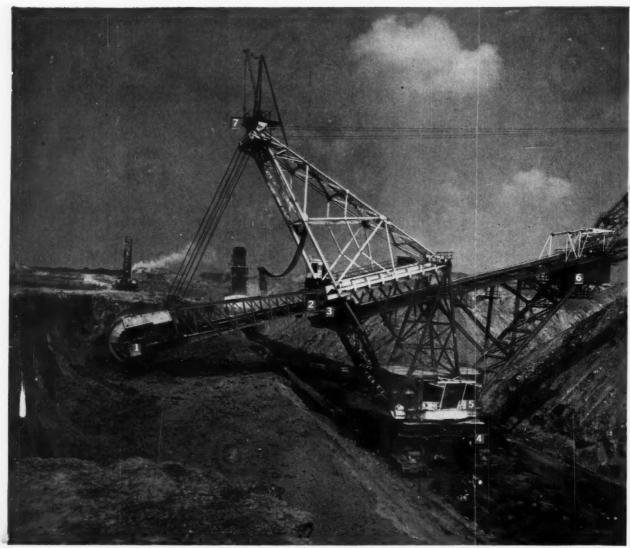


You'll get a stronger weld with this bond than any other bond. The raised shoulder on the terminals forms a deep V-trough between the rail and the bond. You can lay a lot more metal in that notch than you can put on ordinary bonds. That's why you're sure of getting a weld that will really hold. And the bond is just as strong as the weld. Husky steel terminals are butt-welded to the strand for permanence. The joint is actually stronger than the strand. Tigerweld BF-12 Rail Bonds are fast and easy to install because they're self-clamping. Just hammer them on the track and weld. You don't need clamps. For more information on this and other husky rail bonds, write American Steel and Wire, Dept. 1415, Rockefeller Building, Cleveland 13, Ohio. USS and Tigerweld are registered trademarks



American Steel and Wire Division of **United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors Tennessee Coal and Iron Division, Fairfield, Ala., Southern Distributors United States Steel Export Company, Distributors Abroad

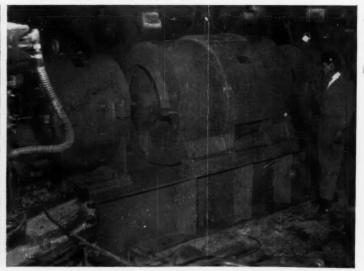


Wheel excavator removes top overburden at Peabody Coal's Freeburg, Ill., strip coal mine. Main drive elements are: 1. Wheel drive motor, 2. Crowd motor, 3. Digging ladder conveyor motor, 4. Propel motors, 5. Motor-generator sets, 6. Stacker conveyor motors, 7. Ladder hoist motor.

100 hp. a-c Westinghouse motor used for crowd motion.

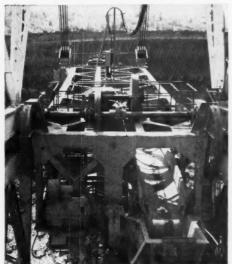


One of two 1000 hp, 4 unit synchronous Westinghouse motor-generator sets with split frame generators and split bracket motor for full accessibility.



136

187½ hp forced ventilated d-c digging ladder conveyor Westinghouse motor (center, left) and 100 hp, a-c Westinghouse crowd motor (rear).



IN OPEN PIT OPERATIONS WESTINGHOUSE MOTORS AND WHEEL EXCAVATOR MAKE POWERFUL TEAM

As ratio of overburden thickness to coal seam thickness hits 20:1 or more (a 10:1 ratio was considered to be a break-even point only a few years ago), open pit operators continually search for new methods to remove overburden more economically.

An example of how one operator is tackling the problem is the Peabody Coal Company operation at its River King mine, Freeburg, Illinois. Peabody has teamed up a giant new wheel excavator with a large stripping shovel. The wheel excavator, manufactured by Bucyrus-Erie Company and exclusively powered by Westinghouse motors, removes the dirt and clay of the overburden. Behind the wheel excavator, the shovel scoops out the shale and hard rock to expose the coal seam.

Preliminary operations indicate that this "tandem" arrangement is much more efficient than a shovel working alone. But, an important part of the forecasted savings originates with the design and operation of the new wheel excavator itself.

It is capable of moving 3000 cubic yards of dirt per hour and depositing, it 400 feet from the digging wheel to the spoil bank. Its crowd motion is up to 45 feet and driven by a 100 hp Westinghouse Lifeline a-c wound rotor motor with a-c reversing starters. This particular motor is well suited to the severe reversing, plugging service and frequent stopping and starting. The motor's rugged frame and feet assure maximum strength and rigidity to shock, vibration and physical abuse. The ladder hoist range of the wheel excavator is 40 to 100 feet at 15° angle and the motion is powered by a 150-300 hp Westinghouse d-c motor. A 90 foot

long ladder conveyor operates continuously at 945 fpm and is driven by a 187.5-375 hp Westinghouse d-c motor. The Stacker conveyor extends 327 feet, moves faster (1260 fpm) than ladder conveyor to avoid pile-up of dirt at transfer point. This stacker conveyor and wheel employs two 250-500 ph Westinghouse d-c motors.

Swing motion of the new machine is operated by two 25-50 hp Westinghouse d-c motors. Low inertia armatures, greater field coil capacity, more torque per ampere - all features of Westinghouse motors — are particularly advantageous for this motion by allowing acceleration, deceleration, start, stop and reverse with a minimum of time and power. Exclusive Westinghouse insulation systems give maximum life and protection; mechanical designs include easily accessible motor leads, split steel frame d-c shovel type motors, steel shell field coil construction, maximum diameter shafts through punchings and with no overhung commutators.

The 3,200,000 lb, 410 ft long, 180 ft high wheel excavator is propelled forward or reverse by four 100 hp, a-c Westinghouse motors, known throughout industry for reliability under tough operating conditions.

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Westinghouse



COAL AGE . November, 1961

Among the Manufacturers

Link Belt Co. has filled three executive posts. Leslie J. Carson, who has been named director of engineering with headquarters in Chicago, will work with Richard F. Bergmann, vice president for engineering. A Link-Belt man since 1934, Mr. Carson had been general manager of the Colmar, Pa., plant since 1952. He will be succeeded in that position by Roderick S. Galloway, formerly general manager of the Atlanta, Ga., plant and southeastern division since 1945. John M. Shepard Jr. fills the general manager job at those two locations.

Henry F. Barnhart has been appointed vice president in charge of sales for the Construction Equipment Div. of Baldwin-Lima-Hamilton Corp. Although his new duties will take him to the executive offices in Philadelphia, Mr. Barnhart will also maintain an office in Lima, Ohio. He will be succeeded in his former post as vice president and general manager of the Construction Equipment Div. by Charles M. Lippincott who held that position at the Austin-Western plant and who will maintain his office in Aurora, Ill.

John W. Thornton has been elected vice president and general manager of the Industrial Div., Joy Mfg. Co., having previously served as vice president, marketing. A Joy employee since 1957, Mr. Thornton is also a consultant to the Office of Coal Research, U. S. Interior Department.

New manager of industrial sales at American Hoist & Derrick Co. is Richard E. McCoach. Mr. McCoach had been with Industrial Brownhoist Corp., having served that firm in various sales posts, most recently as general sales manager.

Manitowoc Engineering Corp. has appointed Ralph Helm, who joined the

firm Sept. 1, to fill the newly-created executive position of director of marketing. Mr. Helm had been vice president, Depco Equipment Co., and before that had been with Marion Power Shovel Co. as Eastern Canadian sales manager.

Marion C. Dietrich has joined Cummins Engine Co. as director—sales (parts and special products) and a member of the company's Executive Committee. In his new post, he will be responsible for parts sales and distribution and special product sales of the firm's domestic subsidiaries.

Nunzi P. Semenza has been named special sales representative for Austin Powder Co. He will work with David P. Harris in promoting sales of Austin explosives and blasting supplies to the coal and other industries in eastern Pennsylvania from his headquarters at the Austin eastern sales office, 148 Adams Ave., Scranton, Pa.

Charles M. Anderson is new general manager, W. R. Stamler Corp. He was first associated with Stamler during the summer months of his college days at the University of Kentucky. Upon graduation, he took employment with an aviation concern and then spent 3 yr with the U. S. Air Force after which he returned to Stamler in 1959.

Donald B. Hicks has transferred from Kaiser Steel Corp.'s home office at Oakland, Calif., to fill the newly-established post of resident sales representative at Fresno, Calif., part of the firm's Central District sales area. An employee since 1953, Mr. Hicks had been a sales representative with Central District for 2 yr.

G. Harvey Porter has been appointed director of marketing services, Black & Decker Mfg. Corp., succeeding Joseph H. Schmidt Jr. who has been promoted to general sales manager of the consumer products division. In addition, William G. Burggraf and William H. Drews have been named assistant advertising managers for the product service and export divisions, and industrial-automotive division, respectively. Effective Oct. 23, Alex N. Dahl became manager, special sales.

Leonard E. Weitz, chairman of the board, Independent Explosives Co., has announced the election of his son, Dr. John H. Weitz, to the presidency of the company. Dr. Weitz, who started with the firm as chief geologist 10 yr ago, became secretary 4 yr later. Recognized as an expert on the use of commercial high explosives in mines, quarries and construction work, Dr. Weitz had been professor of geology at Lehigh University and an economic geologist with the U.S. Bureau of Mines.

Richard F. Ernewein, a tire sales manager for B. F. Goodrich Tire Co. since 1951, has been named manager of truck and industrial tire sales. His career with the company began in 1935 and was interrupted only by a 2-yr period when he left to operate his own retail tire business.

Jack L. Mayfield takes on new duties as sales engineer, Scientific & Process Instruments Div., Beckman Instruments, Inc. He will represent the division in sales of laboratory instruments in northern California and Nevada.

Colorado Fuel & Iron Corp. has promoted W. W. Leonard to manager, tubular sales. Moving up to take over Mr. Leonard's former duties since 1952 as assistant manager, tubular sales, is D. W. Kelly. Mr. Kelly had served in the tubular sales department since 1955 as sales engineer for the Rocky Mountain area.

Company Briefs

Robbins & Myers, Inc. has formed a new division to be known as the Airtrol Div. with headquarters in Springfield, Ohio. Airtrol will specialize in the design, production and marketing of unit type collectors for the control of dusts and mists encountered in industrial and commercial operations. Early fall production is scheduled. E. J. Stone, sales manager of the firm's Propellair Div., has been assigned managership duties for the new division while M. I. Dorfan, well-known dust-control authority, will be responsible for performance and testing of the new line.

R. Casper Swaney has been appointed by Nagle Pumps, Inc. to represent them

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throughout Pennsylvania. The new representative is located at Carlisle, Pa., and his mailing address is Box 215.

General Electric's Metallurgical Products Dept. has named two new Carboloy cutting tool distributors. Keith Sinclair Co., Inc., 1141 Broadway, Nashville, Tenn., will cover north- and south-central Tennessee and five counties in south central Kentucky. B. D. Sinclair is president and B. B. Hyatt, sales manager. The other distributor is Seattle Hardware Co. located at 501 First Ave. S., Seattle 4, Wash. Robert C. Lenfesty is president of this firm which will serve Washington and northern Idaho.

An agreement has been signed for the exchange of research information and for future cooperative development of fuel cells by The Electric Storage Battery Co. and Sun Oil Co. Electric Storage Battery is said to be the country's oldest producer of packaged power devices and a leader in the electrochemical field and in development of electrodes for fuel cells. Sun Oil, reported to be a pioneer in its industry for development of fuels, has conducted an independent research program in catalyst systems used in fuels cells.

A complete "package" of corrosionresistant piping materials is being made available as the result of a license recently awarded Babcock & Wilcox Co. to produce and sell welding fittings and flanges of Yoloy steel to match the Youngstown Sheet & Tube Co. piping of the same alloy.

Yoloy is an alloy which, according to the two concerns, is lower in cost and resists corrosion better than wrought iron. It was developed by Youngstown, producers of seamless and continuous-weld Yoloy pipe. Babcock & Wilcox was selected to manufacture Yoloy fittings and other products because the welding fittings operation of its Tubular Products Div. is integrated with its steel and tube-making facilities, the report said.

The Radio Corp. of America recently announced the expansion of its two-way radio marketing organization through the creation of seven new district sales offices. Their locations and the district sales managers who will direct their activities are: Eastern Sales Region—Pittsburgh, V. J. Bauer; Southern Region—West Palm Beach, M. L. Haas; Southwestern Region—Dallas, J. R. Booth; Central Region—Detroit, E. T. Burgett—Chicago L. J. Shidaker; and Western Region—Los Angeles, E. J. Reichler—Seattle, W. T. Glass.

The expansion program, still under way, contemplates the establishment of a total of 12 additional district offices in the five sales regions. Specify JEFFREY exchange units



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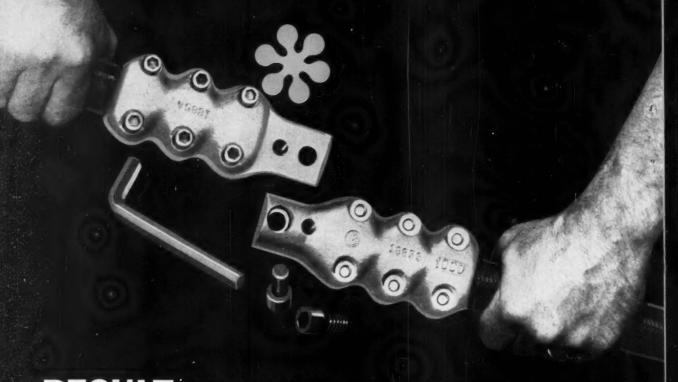
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- 2—12RB Joys, 250 V. D.C., Permissible, dual wheels, bugdusters, 9' bar. Excellent condition 3—11RU Joys, 250 V. D.C., Permissible, Bugdusters, one completely rebuilt 1—70-URB Jeffrey, 250 V. D.C., 9' Bar, Excellent dual
- condition -29U Jeffrey, 220/440 V. A.C., 42" t.g., com-pletely rebuilt
- pletely rebuilt 10—512 Goodmans, 250 V. D.C., Hydraulically or Manually controlled

LOCOMOTIVES

- 3—20 Ton Jeffrey MH77's, 42" & 48" t.g. 1—15 Ton HM828 G. E., 90 h.p. units, 44" O.H., 48" t.g., Excellent 10—13 Tons, 250 V., any gauge

- 1—12 Ton 29B Goodman, 40° 0.H.
 10—10 Tons, 250 V., any gauge
 16—8 Tons, 250 V., any gauge
 24—6 Tons, any gauge
 25—6 Ton Jeffrey MH,150s
 12—6 Ton MH8B Jeffreys
 11—5 Tons, 250 V., any gauge

BATTERY LOCOMOTIVES

- 5—7 Ton Atlas 2—6 Ton Mancha, 36″ t.g., 47″ O.H. 1—4 Ton Mancha, 48″ t.g. 1—Set Gould Locomotives Batteries, 48 Cell

CHAIN AND SHAKER CONVEYORS

- 20" Joy Chain Conveyors, A.C. & D.C., Permissible 15" Chain Conveyors Prives, A.C. & D.C. Permissible 15" Long Chain Conveyors, A.C. & D.C. 12" & 15" Jeffrey Chain Conveyors 12" Goodman Chain Conveyors 12" Goodman Chain Conveyors PT-12 Long Piggyback Conveyors PT12-B Long, Piggyback Conveyors Goodman G12½, G15 & G2O Shaker Conveyor Drives Joy Ladel UNIT Shaker Conveyor Drives Goodman Power Duckbills & Duckbill Hoists

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- 27—36" f.g., Drop Bottom
 150—42" f.g. End Dump, various makes
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 16—42" f.g., S.C., Drop Bottom
 150—44" f.g., Drop Bottom various sizes
 303—44" f.g., End Dump, various sizes
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 - 1-TD9 International Ni-Lift
 - 1—Canton Track Cleaner, Excellent 14—HKL, HL & CR Brown Fayro & Sullivan Hoists

- 14—HKL, HL & CR Brown Fayro & Sullivan Hoists
 59—Hoists from 1½ to 800 h.p.
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-29UC Jeffrey Top Cutters.
-35B Jeffrey Cutters.
-35B Jeffrey Cutters.
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RECTIFIERS, 275 Volt DC, Primary 2300/4160 1—300 KW General Electric Portable Rectifier 1—400 KW American Selenium Rectifier

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MOTOR GENERATORS—250 & 275 Volts DC
1—300 KW, G.E. MG Set, primary 2300/4160, 1200 RPM
1—G.E. 200 KW MG Set, primary 2300/4160, 1200 RPM
1—200 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
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1—300 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
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1-75KW Diesel Gen. Set, 250 V. DC with 671 GM

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Primary 2300/4000
1—300 KW Westinghouse, Pedestal Type
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1-36" Barber Greene Lattice Frame Conveyor, 80" long. 1002—26"—97C Goodman Belt Conveyor, complete, —MTB-30 Joy Belt Head & Tails, only. 1000' Joy MTB-26 Conveyor, complete—excellent. —MTB—26" Joy Heads and Tails, complete.

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1—350' LaDel Conveyor Line, complete 2—61AM Jeffery Conveyors—300' long. 1—51HG Jeffrey Chain Conveyor, 40' long. 1—Jeffrey 300'—15" Chain Conveyor.

LOCOMOTIVES

LVCOMOTIVES

1—G.E. 6 Ton Locomotive w/Reel, 36" gauge.

1—1030 Goodman Locomotive, 24" high, 44 " gauge.

1—1030 Goodman—Type 81A04T, Modern.

1—Goodman—Type 81A04T, Modern.

1—Goodman 13 Ton 1368-0-48 w/75 HP Motors.

2—13 Ton Jeffrey Locomotives

1—Goodman 5 Ton 3012 with 50 HP Motor.

4—8 Ton 132A442-48R Goodman w/2—50 HP Motors.

1—8 ton 132A442-48R Goodman w/2—50 HP Motors.

1—8 ton LM2-8-T.DD G.E. with 2—50 HP Motors.

3—6 ton LM2-6-8-T.DD G.E. with 2—35 HP Motors.

2—6 ton LM2-6-8-T.DD G.E. with 2—35 HP Motors.

3—6 ton LM2-6-8-T.DD G.E. with 2—35 HP.

3—Greensburg Monitors complete charging equipment.

ELEVATING CONVEYORS

5-PL11-16RPE Joy Elevators.

1—36°x36" Double Roll Crusher with 100 HP Motor.
1—Roblins 36°x36" Double Roll Stoker Crusher.
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173—ACEF Drop Bottom Cars, 48" high, new condition. 5-Mantrip Cars.

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CMI 48" Dryer with motors, drives, belt, etc., screen cloth 1/16" opening, capacity 90 tph.
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 1—18x14 Allis Chalmers Centrifugal Pump, com-

piete. 1—Roberts & Schäefer Eleptic Vibrator. 1—Roberts & Schäefer Air Drying Plant, complete.

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MACHINE TRUCKS, 250 Volts DC 2-T2-5APE Joy Machine Trucks.

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25—CP-472 Electric Coal Drills, 250 Volts DC.
5—CP-572 Coal Drills, 250 Volts DC.
10—Chicago Pneumatic Little Giant Coal Drills, 220 Volts AC.
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5—Dooley Self-Propelled Drill Trucks, twin-armed, track or rubher.

ROOF BOLTING MACHINES

HOISTS

10-Vuican-Denver #111/2 Material Hoists W/motors.

Brownie Hoists, 5 HP, AC

Brownie Hoist, HKO, good condition.

COMPRESSORS

2-Acme Self-Propelled Air Compressors, Model 168.

ROCK DUSTERS 2—Manson 24-S Wet Rock Dusters.

2—MSA Rock Dusters, 25 H.P. Track

2—MSA Bantam Rock Dusters, rubber tired.

1—American Mine Door Rock Duster, 22" high.

1—Jeffrey 8H-42 Aerodyne Fan complete w/motor,
"" belt & tubing.
1—Jeffrey 8H-60 Aerodyne Fan complete w/G.E.
100 H.P., 440 V. AC Motor & Auxiliary Ford Industrial Power Unit.

CONTINUOUS MINERS

2—10M Joy Continuous Miners, 250 Volts DC.

1—Goodman Continuous Boring Machine, 440 Volts AC, 250 HP, can be converted to twin borer.

1—510M Joy Continuous Miner with self-tramming and extensible belt, 440 Volt AC complete with 1000 ft. of structure and belting.

MISCELLANEOUS 20—40 lb. Switches, complete. 20—60 lb. Switches, complete. 1—American Mine Door Automatic Electric Throw

75 HP Starter for AC Wound Rotor Motor, drum type complete with resistance. 3—2300/4160 Y—230-115 Volt—200 KVA G. E.

3—2300/115/230 Volt—15 KVA G.E. Transformers,

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1—4x10 Double Deck Vibrating Screen.
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2—Joy 148U Leaders, low pedestal, 7AE, 1956 & 57.
4—Joy 148U Leaders, medium pedestal, 7RBE.
2—Joy 148U 7EE high pedestal loaders.
4—Joy 148U 3PE Leaders.
2—Joy 128U Leaders, experies of the property of JOY EQUIPMENT-REBUILT v. Dt.. -Goodman 665 Loader on Crawlers, latest type 250 V. DC. -Goodman 865 Loader, 26" hi. 250 V DC. -Joy 85C Shuttle Cars, 26" hi., rebuilt. -85C Shuttle Cars, as removed from service. 26" 5—85C Shuttle Cars, as removed from service. 26" hi,
4—Jay 6SC Shuttle Cars, rebuilt, latest type.
6—Jay 6SC Shuttle Cars, as removed from service.
1—Jay 5SC Shuttle Cars, as removed from service.
1—Jay 5SC Shuttle Cars, rebuilt.
2—Jay 32E1 Shuttle Cars, rebuilt.
6—Jay 32E1 Shuttle Cars, rebuilt.
1—Jay 32E1 Shuttle Cars, rebuilt.
16—Jay 32E1 Shuttle Cars, rebuilt.
16—Jay 42E16 Shuttle Cars, rebuilt.
16—Jay 42E16 Shuttle Cars, rebuilt.
16—Jay 1-2 Slow pan Crawler Trucks, rebuilt.
1—Jay 7-2 Slow pan Crawler Trucks, rebuilt.
1—Jay 7-1 Standard Crawler Trucks, 220 AC.
1—Jay 7-1 Standard Crawler Trucks, 250 DC.
1—Jay 7-1 Standard Crawler Trucks, 250 C.
1—Jay 7-1 Stuffing Machines, 19" high.
2—Goodman 312 Cutting Machines, 19" high.
2—Goodman 312 Cutting Machines, 19" high.
1—Goodman Machine on Crawler, 31" high. All hydraulic. -Goodman Machines with Bugdusters. Re-built and as removed from service.

Goodman 612 Cutting Machines, 250 and 500 Jeffrey 70 URB rubber tired Cutter, Universal

—Jeffrey 70 URB rubber tired Cutter, Universal head, perfect condition.
—Jey 11RU Rubber Tired Cutter with Bugduster, Universal head, dual tires, like new, 250 v. DC.
—Jey 10RU Rubber Tired Cutter, Universal head, 250 v. DC. Rebuilt or as is.
—Soodman 2400 Rubber Tired Cutter, like new, Universal Head, 34" overall height.
—Sullivan 7AU on Dual Rubber Tires, 250 v. DC.
—7AU's on track. Universal head.
—Jeffrey 29UC Cutting Machines, Universal head, cuts anywhere in seam, 38" high, on Crawlers, 250 voit D.C.
—Jeffrey 29LC on Crawlers, rebuilt or as removed from service.

LOCOMOTIVES

1—Goodman 6 ton, 93-A, 27" hi, armor plate frame. 1—Jeffrey 15 ton MH-77 Locomotive, armor plate frame. Jeffrey, 13 ton, Type MH-110, 36", 42", 44" ga. Jeffrey, 10 ton, type MH-110, 42" and 44" ga. Jeffrey, 10 ton, type MH-78, 42" and 44" ga. Geodman 8-30 and 10-30 Lecos., 26" above rail. Jeffrey MM-150, 6 ton, 26" overall height, re-built with reel. -Jeffrey, 6 ton, type MH-88, 42", 44" and 48" ga. -Jeffrey, 8 ton, type MH-100 2½" armor plate 4—leffrey, 8 ton, type MH-100 2½" armor plate frames.
3—leffrey, 4 ton, type MH-86, 42", 44", 48" ga. 1—6.E., 4 ton, type 825 Lecometrive, 22" high.
10—6.E., 6 ton, types 801, 803, 821 Locomotives, 42", 44" and 48" ga. 1—6.E., 8 ton, type 822 Locometrive, 44" ga. 3—6.E. 830, 12 ton, Locometrive, excellent. 2—6.E. 330, 12 ton, Locometrive, excellent. 2—6.E. 13 ton, type 829 Loco., armor plate frames. 1—800dman, type 33, 6 ton, 44" and 48" ga. 3—800dman, type 33, 6 ton, 44" and 48" ga. 1—Atlas Battery Locomotive 36" ga. 1—Atlas Trolley Locometrive, 4 ton, 24" high. 2—Westinghouse, type 904, 6 ton, 44" and 48" ga. 2—Westinghouse, type 906, 44" and 48" ga. 2—Westinghouse, type 906, 44" and 48" ga. 3—Westinghouse, type 906, 44" and 48" ga. 3—Westinghouse, type 906, 44" and 48" ga. 3—Westinghouse, type 906, 44" intis, real bargains. 6—leffrey MH-78 Locomotive Units, reasonable. 3—lymouth Diesel Locomotive Units, reasonable. 3—leffrey MH-8 Locomotive Units, reasonable. 3—leffrey MH-8 Locomotive Units, reasonable. 3—leftrey MH-8 Locomotive Units, reasonable.

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1—All Steel 5 Track Tipple, new 1957, complete with washer, silo, oil treating system, all bolted construction.

—Complete Five Track Tipple with Washers and Air Tables.

—Complete Stoker plant, all steel.

—Complete Hipples, 3 & 5 track, steel and wood.

—Cleaning Plants, 1 Ea. McNally, Roberts and Schaefer, Jeffrey, Washers and Air-Fio Tables.

—Complete Aerial Trams for coal or refuse.

—Complete Aerial Trams for coal or refuse.

—Monitor Lines complete with Drums, excellent.

—Allis-Chalmers 4 x 12 Low-Head Vibrator.

—Robins Gyrex Vibrator, 4 x 10.

—Belt and Apron type Loading Booms.

6—Shaker Screens.

10—Belt and Apron type Löading Booms.
6—Shaker Screens.
1—Robins Car Shakeout.
1—Gundlach Crusher, like new.
20—Crushers, various sizes—Jeffrey, Link-Belt,
Lanahan & McNally.
4—Mine Scales, 10 & 20 ton.
5—Truck Scales, 25 to 40 ton, New & Used.
Feeders, Belt and Drag Conveyors, Car Retarders. -Jeffrey, Link-Belt, Mc-

CUTTING MACHINES

1—Joy 10RU Rubber Tired Cutter, Universal head, 250 V. D.C. As is or rebuilt.

- Joy 11RU Rubber Tired Cutter, 250 V. D.C.

- Goodman 2400 Rubber Tired Cutter, like new, Universal Head, 3ª overall height.

- Jeffrey 29UC Universal Machines on Crawlers.

— Jeffrey 29UC Universal Machines on Crawlers, Goodman on Crawlers, 31" overall height. — Baby Goodman 212's, rebuilt, 250 V. D.C. — Goodman 312 Cutting Machines, 17" high. — Goodman 512's, with Bugdusters, like new. — Goodman 512's, vieth Bugdusters, like new. — Goodman 512's, rebuilt, or as removed from service.

6—BOOdman 512's, rebui.t, or as removed from service.

Goodman 512's, rebui.t, or as removed from service.

Goodman 612's—250 & 500 Volt.

Goodman 112's, 220 /440 V. A.C.

Joy 7-B Cutting Machines, 250 and 500 Volt.

Joy 11B Cutting Machines, rebuilt, 35 & 50 H.P.

FAU's, on track, Universal Head.

GOOdman 12AA's and 112AA's, 250 V. D.C.

Goodman 12AS Islabers.

Goodman 224 Slabbers.

Goodman 224 Slabbers.

Goodman 224 Slabbers.

Jeffrey 35L's, like new, 250 V. D.C., 17" high.

Jeffrey 35L's, in low vein trucks.

Jeffrey 35BS, 220 /440 A.C.

Jeffrey 29B's on track.

Jeffrey 29B's on track.

Jeffrey 29C's, track mounted.

Zeleffrey 29L's, or Cawlers. Excellent.

CONVEYORS

2—Joy 1200' Belt Conveyors, 30". "Limberroller," like new.

1—Each 30" and 36" Joy 1000' extensible belt, latest type, like new.

1—Goodman 97HC 30" Rope Belt, 1000' perfect. With or without rubber.

2—Jeffrey 52-B tandem drive 30" Belt Conveyors, 600' to 2000'.

1—Joy 30" Underground Belt Conveyor, Excellent.

1—Goodman 97-C, 30" tandem drive.

2.000' 52-B Belt Structure, 30".

2.000' 52-B Belt Structure, 30".

1.000' Conveyor Belt, 42".

1.500' Conveyor Belt, 42".

1.000' Conveyor Belt, 26".

2.000' Conveyor Belt, 26".

2.000' Conveyor Belt, 30".

2.000' Conveyor Belt, 30".

2.000' Conveyor Belt, 30".

2.000' Conveyors, 300'.

2.001' S2" Conveyors, 300'.

2.001' S2" Conveyors, 300'.

2.001' S2" Conveyors, 300'.

4.001' Goodman 6-12', and G-15 Shakers.

1.000' Goodman 18" Flat Belt Conveyors, tandem drive any length. Perfect. 2-Joy 1200' Belt Conveyors, 30". "Limberroller,"

CONVERTERS AND DIESEL PLANTS

CONVERTERS AND DIESEL PLANTS

1-300KW 6.E. Stationary Rectifiers.

4-1,000KW Stationary Rectifiers.

4-1,000KW Stationary Rectifiers.

4-1,000KW Stationary Rectifiers.

1-150KW, 6.E. TCC-6's, 275 V., Rotary Converters.

1-150KW, 6.E. HRC-6, 275 V., Rotary Converter.

1-150KW, 6.E. HRC-6-8, Rotary Converters, 275 V.

D.C. Steel frames. Newly rewound.

3-300KW 6.E. HCC-6's, Rotary Converters, 275 V.

D.C. Like New.

2-300KW Westinghouse, 6 phase, Rotary Converters, 275 V.

2-300KW Westinghouse, 6 phase, Rotary Converters, 275 V.

1-300KW Westinghouse, 6 phase, Rotary Converters, 275 V.

-500KW West. Rotary Converters, 275 V. D.C. -200KW Westinghouse Rotary Converters, 275 V. D.C. Newly rewound. (All the above with 6900/13000 and/or 2300/-4000 primary transformers) -50KW MG Set.

4000 primary transformers)

- 50KW MG Set,
- 100KW MG Set,
- 110KW MG Set,
- 110KW MG Set, 275 V. D.C.
- 150KW MG Sets, G.E. and West., 275 V. D.C.
- 200 KW MG Sets, G.E. and West., 275 V. D.C.
- 200 KW MG Set, G.E., perfect, 275 V. D.C.
- 200 KW MG Set, G.E., perfect, 275 V. D.C.
- 300 KW G.E. MG Sets, like new.
- 300 KW Westinghouse, 600 volt MG Set, rebuilt.
- 500 KW G.E. 275 volt MG Sets, 2300-4000 V. primary rebuilt.
- 200 KW Westinghouse, 600 volt MG Set, rebuilt.
- 200 KW G.E. Rotary Converters, 600 V. D.C.
- 300 KW West., 600 volt, 5 phase, Rotary Conv.
- 300 KW G.E. Rotary Converter, 500 V. D.C.
- 500 KW G.E. Rotary Converter, 275 V. D.C., 6 ph.
- 500 KW G.E. Rotary Converter, 275 V. D.C., 6 ph.
- 500 KW G.E., MCC-6's, Rotary Conv., 6 phase, 600 V. D.C.
- 6MC-671 Diesel w/75 & 110 KW, 250 V. D.C.
- Cat. 318 Diesel with 75 KW Generator.
- 100 KW G.H. Diesel with 50 KW, 250 V. D.C. Gen.
- 6MC-471 Diesel with 60 KW, 250 V. D.C. Gen.

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MISCELLANEOUS 1—Jeffrey 76-A CelMel, 220 /440, norfect. 1—Joy 5 JCM Continuous Miner, 220 /440, perfect. 150 Tons Copper 4/0 and 9 Section Trolley 1/0 2/0 4/0 Stranded, 500 MCM, 750 MCM—1,000,000 150 I ans Lapper 4/0 and 9 Section Triety 1 of 0.7

4/0 Stranded. 500 MCM, 750 MCM—1,000,000 MCM Insulated.

1 Each 4/5 6 & 8 Hi Pressure Joy & Jeffrey latest type fans.

1—Complete Five Track Tipple with Washers and Air Tables.

5—Complete Tipples, 3 to 5 track. Wood and Steel. Steel Trestles for drop bottom cars.

All Steel Armos Buildings.

20—Jeffrey Molveyors on rubber tires.

1—34 Yard Shovel and Back-Hoe.

2—34 Yard Crawler Cranes. Gas.

Battery Supply Tractors, Rubber Tired.

1—Cantrell Air Compressor on rubber tires.

10—Air Compressors. 1 H.P. to 40 H.P.

10—Self-propelled rubber tired comp., 240 cu. ft.

1—Acme self-propelled rubber tired compressor, 130 cu. ft.

40—Mine Pumps all types.

130 cu. ft.

Mine Pumps all types.
1—Differential 40 Passenger Man-Trip Car.
5—MSA Rock Dusters.
19y Roof Drills—Schroeder Coal Drills.
2—Phillips Carriers, 44" and 48" ga.
1.—Barber-Greene self-propelled Bucket Elevator.
Pine Plastic, Steel, Transit, all sizes 1" to 6".
25.000 Roof Bolts, all types.
300—Mine Cars, drop bottom, 42", 44", 48", ga.
300—Mine Cars, 18" hi., end dump, 42", 44", 48" ga.

ga.
1—10 ton Mine Car Scale with Recorder.
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15—Brown Fayro HKL and H6 Car Spotters.
1—Brown Fayro Hydraulic Car Spotter.
1—12 ton Differential Slate Larry.
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Shaft Hoists to 700 H.P. Complete.

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2,000 Five Gallon G.I. Cans, screw lids.

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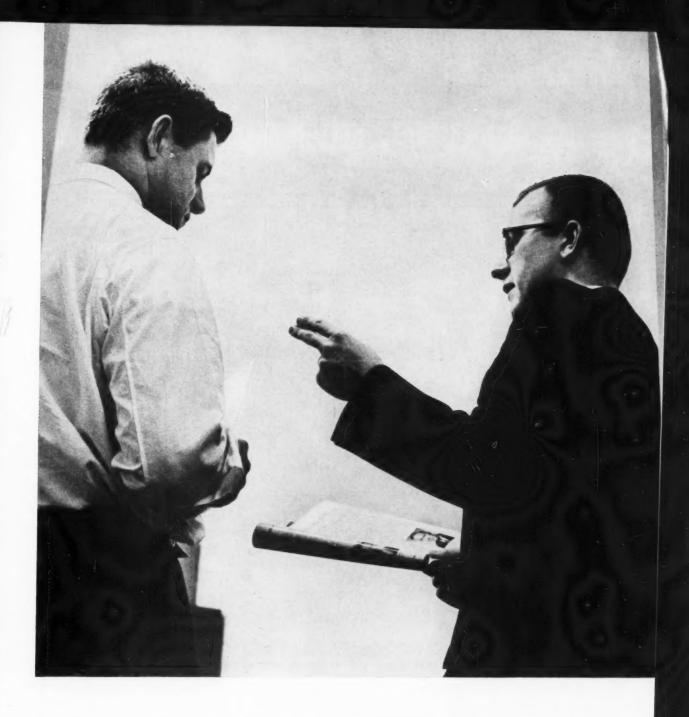
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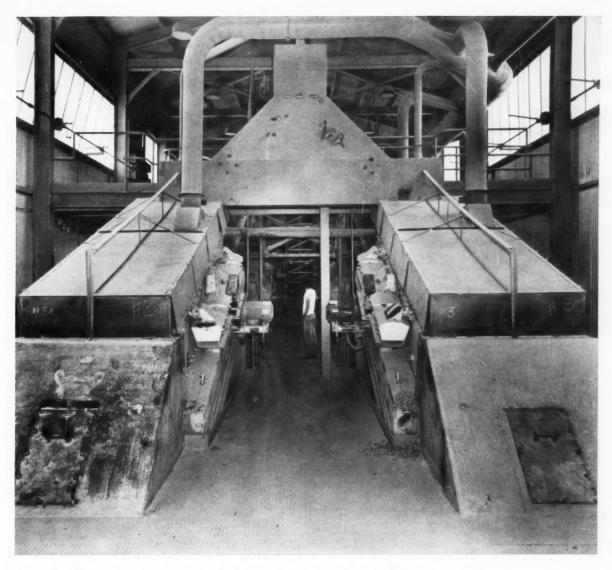
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